UNITED STATES ENVIROMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
CHEMICAL SAFETY
AND POLLUTION PREVENTION

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MEMORANDUM

SUBJECT: Preliminary Environmental Fate and Ecological Risk Assessment for the Registration Review Risk Assessment of Propamocarb HCl

FROM: Hannah Yingling, Biologist Hannah Yingling 12/20/2016
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Please, find attached the subject document.

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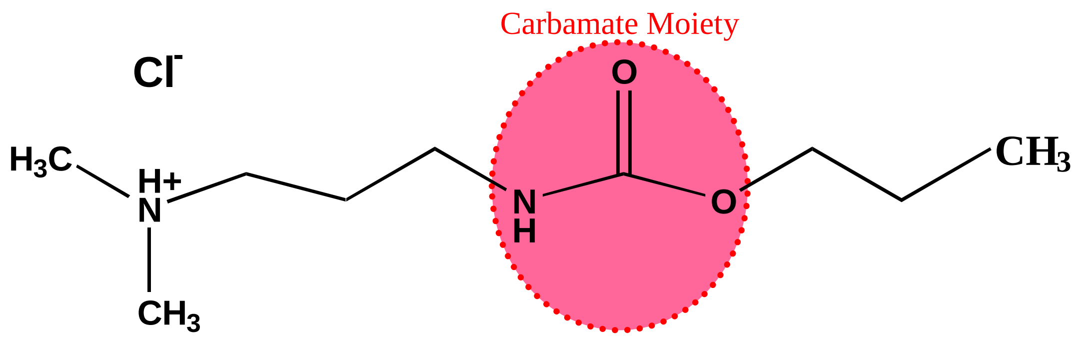
Preliminary Environmental Fate and Ecological Risk Assessment for the Registration Review of Propamocarb HCl



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Executive Summary

The Environmental Fate and Effects Division (EFED) has completed the preliminary ecological risk assessment for the Registration Review of the fungicide propamocarb (Propyl N-[3-(dimethylamino) propyl] carbamate hydrochloride, herein referred to as propamocarb. Propamocarb is stable to abiotic hydrolysis and photolysis and that the main route of dissipation is through aerobic soil/aquatic systems metabolism. A significant part of the parent dissipation appears to be related to mineralization to CO_2. Residues from propamocarb degradation consists of 2-7 minor un-identified degradates and in some soil significant amounts of un-extracted residues that appear to decline in some of these soils. Propamocarb works by disrupting the formation of fungal cell walls by interfering with the synthesis of phospholipids and fatty acids. It affects mycelial cell growth, spore production, and germination of the fungus.

Propamocarb is slightly toxic to fish (and to aquatic-phase amphibians for which fish serve as surrogates) and is practically non-toxic to slightly toxic to aquatic invertebrates; new data for chronic toxicity to freshwater invertebrates has been presented in this assessment. The compound is practically non-toxic to slightly toxic for birds (and to terrestrial-phase amphibians and reptiles for which birds serve as surrogates) and practically non-toxic to mammals on an acute basis. Propamocarb is practically non-toxic to terrestrial invertebrates (based on acute contact data.)

Table 1 provides a summary of the environmental risk conclusions to aquatic and terrestrial organisms based on the risk quotient (RQ) values and whether they exceed the levels of concern (LOCs) for Federally-listed threatened and endangered species (hereafter referred to as listed species) and non-listed species.

Table 1. Summary of Ecological Risk Conclusions for the Propamocarb Uses	
Taxonomic Group	**Summarized Risk Characterization and Major Uncertainties**
Fish and Aquatic Invertebrates (freshwater and estuarine/marine) (including aquatic-phase amphibians for which fish serve as surrogates)	The potential for acute[1] or chronic risk to freshwater and estuarine/marine fish and is considered low, as acute or chronic RQ values do not exceed the acute risk to listed species LOC of 0.05 or non-listed species LOC of 0.5 and chronic risk LOC of 1.0; (maximum RQs ranging from 0.022 to 0.140)
Aquatic and Terrestrial Plants	The potential for risk to aquatic plants is considered low, as the RQ values do not exceed the LOC values for risk to listed and non-listed aquatic plants of 1.0; (maximum RQs ranging from <0.01 to 0.03). There were two incidents to terrestrial plants that are associated with use of propamocarb. There is a potential for risk to listed and non-listed terrestrial plants[1], specifically, monocots and dicots in semi-aquatic areas; (upper bound estimate of risk = 4.42).
Birds (plus terrestrial-phase amphibians and reptiles for which birds serve as surrogates)	There is a potential for risk to listed and non-listed birds on an acute[1] (upper bound estimate of risk = 22.82) and chronic basis (highest RQ 115.54); Highest RQs associated with use on ornamentals[2]. There are exceedances for the acute dose based, acute dietary based, and

Table 1. Summary of Ecological Risk Conclusions for the Propamocarb Uses	
Taxonomic Group	**Summarized Risk Characterization and Major Uncertainties**
	chronic RQs; the acute LOC exceedances are associated use on turn and ornamentals[2], the chronic LOC exceedances are associated with all use patterns.
Mammals	There is a potential for risk to listed and non listed mammals on an acute[1] (upper bound estimate of risk = 6.26) and chronic basis (maximum RQ 200.36); maximum RQs associated with use on ornamentals. There are exceedances for the acute dose based, chronic dose based and chronic dietary based RQs; these acute and dietary based chronic LOC exceedances are associated with use on turf and ornamentals[2], the dose based RQ exceedances are associated with all use patterns.
Bees	**Tier 1 Risk Assessment.** Based on Tier 1 acute contact risk assessment of adult honey bees, one RQ value exceeds the acute risk LOC of 0.4; this exceedance is associated with the highest application rate. No data is available on the toxicity of propamocarb on an acute oral basis.
[1] There is uncertainty concerning the acute RQs for both mammals and birds; the endpoints used in risk quotient formulation were non-definitive greater than values and thus are considered to be an upper bound estimate of risk. Because these values were used in RQ calculations, the acute RQs can be considered to be conservation and an indication of the "worst case scenario." Regardless, there are numerous acute RQs that are well above the LOC. [2]There is some uncertainty associated with the high use rate associated with use on ornamentals; rates modeled are consistent with those cited on labels. If this is inconsistent with the actual use rate of the chemical, the rate listed on labels will continue to be used for risk assessment purposes until labels are amended by the registrant.	

1.0 Problem Formulation

The purpose of problem formulation is to provide the foundation for the environmental fate and ecological risk assessment being conducted for propamocarb. The problem formulation sets the objectives for the risk assessment and provides a plan for analyzing the data and characterizing the risk. As part of the Registration Review process, a detailed Problem Formulation (DP Barcode D349574) for this risk assessment was published to the docket [Docket ID: EPA-HQ-OPP-2011-0662] in September 30, 2011. The following section summarizes the key points of that document and discusses any differences between the analysis outlined previously and the analysis conducted in this risk assessment.

1.1 Nature of Regulatory Action

The risk assessment is conducted as part of the Agency's Registration Review process for pesticide active ingredients. The Registration Review process was established under the Food Quality Protection Act (FQPA 1996).

1.2 Stressor Source and Distribution

1.2.1 Mechanism of Action

The mode of action of Propamocarb (CAS No. 25606-41-1) is classified by the Fungicide Resistance Action Committee (FRAC, 2010a) as a "Group 28" fungicide, with a low to medium risk of resistance. Because resistance to propamocarb has been identified in greenhouse isolates of *Pythium* spp. (Pest Management Guidelines, 201la; FRAC. 2010b) resistance management strategies have been recommended with its use (BEAD Memo, April, 2011). The fungicide works by disrupting the formation of fungal cell walls by interfering with the synthesis of phospholipids and fatty acids. It affects mycelial cell growth, spore production, and germination. Disease control is mainly by protection as Propamocarb has little curative action once an infection has started[1].

The chemical is a systemic fungicide with protective qualities against several oomycete (water molds) species (e.g. *Phytophthora* spp., *Pythium* spp., *Bremia lactucae* [lettuce downy mildew], and *Pseudoperonospora cubensis* [cucurbit downy mildew]).

1.2.2 Exposure

The Measures of exposure to aquatic animals and plants are concentrations in surface water and pore water simulated by the surface water concentration calculator (SWCC)[2] which generates the estimated environmental concentrations (EECs) of propamocarb in surface water that may occur from use on adjacent crops based on maximum labeled single and yearly use rates among many other parameters. The EECs used in assessment of acute risk are 1-in-10 year return frequency daily maximum values (referred to as "peak" values). For chronic risk assessment, mean concentrations over a specified duration are generated. In both cases, each modeled site is selected to represent a site expected to be more vulnerable to runoff than most locations where use may occur (*e.g.*, based on the crop being grown).

1 http://www.agf.gov.bc.ca/pesticides/infosheets/propamocarb_hcl.pdf
2 http://www.epa.gov/pesticides/science/models_db.htm

One way terrestrial wildlife may be exposed to propamocarb is via consumption of residues on food items generated by spray applications. For spray applications, the T-REX model (Terrestrial Residue EXposure model; v. 1.5.2; June 6, 2013[3]) is used to predict dietary exposure to propamocarb residues on foliar surfaces and insects using the Kenaga nomogram as modified by Fletcher (Hoerger and Kenaga 1972, Fletcher ***et al.*** 1994). A default 35-day foliar dissipation half-life is used for terrestrial exposure modeling in this assessment, as suitable foliar dissipation data specific to propamocarb are not available (*e.g.* Willis and McDowell 1987). Estimated exposures of terrestrial insects to propamocarb are evaluated in terms of the insects' potential relevance as dietary items for terrestrial vertebrates and for use in risk characterization for listed terrestrial invertebrates.

The TerrPlant (v. 1.2.2; December 26, 2006) model is used to derive EECs relevant to terrestrial and wetland plants for the uses of propamocarb. The model employs the assumption that default fractions of the intended application are transported to an adjacent field through runoff and spray drift. Measures of exposure to terrestrial plants are expressed as a fraction of the mass of the propamocarb applied to the treated field.

The Bee-REX Model, as is outlined in the Guidance for Assessing Pesticide Risk to Bees, signed in June 2014, is used to derive EECs relevant to adult and larval bees for exposure via contact or oral. A full summary of the model and its assumptions can be found within this guidance.

The Screening Tool for Inhalation Risk (STIR, v.1.0, August 2010) was used to calculate an upper bound estimate of exposure using propamocarb's vapor pressure and molecular weight for vapor phase exposure as well as the maximum application rate and method of application for spray drift. STIR incorporates results from several toxicity studies including acute oral and inhalation rat toxicity endpoints. Based on the results of the STIR model, exposure through inhalation of spray drift of the vapor phase of propamocarb was not determined to be a potential pathway of concern for avian or mammalian species on an acute exposure basis for all uses except for ornamentals. For a sample of the output generated by STIR for propamocarb, please see **Appendix D**.

The Screening Imbibition Program (SIP, v.1.0, December 2010) was used to calculate an upper bound estimate of exposure using propamocarb' s solubility and the maximum daily water intake of birds and mammals. SIP incorporates the results from several toxicity studies from birds and mammals. The tool is designed for qualitative use and results in a ratio of exposure to toxicity and determined whether or not drinking water may be a concern for birds and mammals. Based on the solubility and toxicity of propamocarb, exposure through drinking water alone is not a concern for mammals. Exposure through drinking water alone is a potential concern for birds. For a sample of the output generated by SIP v.1.0 for propamocarb, please see **Appendix E**.

Potential for risk to piscivorous mammals and birds and evaluated using the K_{OW}-based Aquatic BioAccumulation Model (KABAM model, v.1.0, April, 2009). Given the very low log KOW of propamocarb (log k_{ow} = -1.36) this analysis was not conducted, and risk below the level of concern is expected for this route of exposure.

[3] Information about the models can be found at http://www.epa.gov/pesticides/science/models_db.htm

1.3 Stressor of Concern

In order to determine the stressor of concern for aquatic exposure two factors are considered: exposure and toxicity of parent and any other degradate(s). In case of propamocarb, mineralization to CO2 is the major degradation process with no other identified degradate. Therefore, the stressor of concern is parent, propamocarb HCl and its dissociated products. In this respect, it is important to note that un-extracted residues (UER) were considered as bound residue and was not included in calculating the soils half-lives used in modeling.

1.4 Risk Hypothesis

A risk hypothesis describes the predicted relationship among the stressor, exposure, and assessment endpoint response along with the rationale for their selection. For propamocarb, the following ecological risk hypothesis is employed for this national-level ecological risk assessment:

> *Propamocarb, when used in accordance with registered labels, will likely lead to off-site movement of the compound via runoff, spray drift, and eroded soil leading to exposure of non-target plants and animals. Based on information on environmental fate, mode of action, direct toxicity, and potential indirect effect, EFED assumes that registered uses of propamocarb have the potential to cause reduced survival, growth, and reproduction to non-target terrestrial and/or aquatic animals and plants.*

2.0 Exposure Characterization

2.1 Use and Usage Information

2.1.1 Labeling

There are four labels for the turf and ornamental use and three labels for the use on some vegetables, Lima beans, and x-mass/Conifer Tree plantations. Turf and ornamentals labels are**:** Banol **432-942** (Soluble Concentrate from Bayer); Proplant **55260-9** (Soluble Concentrate from Agriphar); V-10162 VPP **59639-143** (Flowable Concentrate from Valent); and Advan **83070-8** (Soluble Concentrate from Advan). Labels for vegetables, Lima beans, and x-mass/conifer tree plantations are: Previcure Flex **264-678** (Flowable Concentrate from Bayer); Promess **55260-10** (Emulsifiable Concentrate from Agriphar); V-10162 Premix **59639-142** (Flowable Concentrate from Valent). All of the above stated current propamocarb labels were evaluated and important application parameters are summarized in **Table 2** for turf and ornamentals use patterns and in **Table 3** for vegetables and Lima beans use patterns.

Table 2. Use rate for propamocarb on turf and ornamentals (refer to abbreviations[1])						
Label	**Use Pattern**	**MSR**	**MNA**	**MYR**	**MAI**	**Notes**
Banol 432-942 (Bayer)	Turf	8.17	NS	25.0	7	For > 4" pots (refer to note below)[2]
	Seeding/Seedling	45.9	2	91.9	7	
	Transplant Cutting	81.7+46.9	2	128.6	7	
	Woody Plants	63.8	2	127.6	7	
	Potting: 4"	64.3	2	128.6	7	
Proplant 55260-9 (Agriphar)	Turf	8.17	NS	24.5	7	For > 4" pots (refer to note below)[2]
	Seeding/Seedling	45.9	2	91.9	7	
	Transplant Cutting	81.7+46.3	2	128.0	7	
	Woody Plants	63.8	2	127.6	7	
	Potting: 4"	64.3	2	128.6	7	
Advan 83070-8 (Advan)	Turf	8.17	NS	24.5	7	For > 4" pots (refer to note below)[2]
	Seeding/Seedling	45.9	2	91.9	7	
	Transplant Cutting	81.7+46.3	2	128.0	7	
	Woody Plants	63.8	2	127.6	7	
	Potting: 4"	64.3	2	128.6	7	
VPP 59639-143 (Valent)	Turf	2.12	2	4.25	14	
	Ornamental	Use Omitted from Label				
Turf: Overall Application Parameters		8.2	3	24.6	7	Maximum rates/Number of applications/Minimum Intervals
Overall Application Parameters for Ornamentals		64.3	2	128.6	7	

[1] Abbreviations: MSR= Maximum Single Rate (lbs. a.i/A); MNA= Maximum Number of Applications; MYR=Maximum Yearly Rate (lbs a.i/A) assuming yearly rates= seasonal rates; MAI= Minimum Application Intervals (days); Number in Red is calculated.
Note: values of MNA in red bold are calculated by dividing MYR over MSR.
[2] For pot sizes >4": It is assumed that the label yearly rate restricts the single rate per/pot and the number of pots that can be placed/treated per acre.

Table 3. Use rate for propamocarb on vegetables, Lima beans and x-mass/conifer tree plantations (refer to abbreviations[1]; Type of Application: Aerial, Ground, Band & Chemigation)					
Crop / Use Site	**EPA Reg. No.**	**MSR**	**MNA**	**MYA**	**MAI**
Cucurbit vegetables	59639-142	0.90	4	3.40	10
	264-678	0.90	NS	4.50	7
	55260-10	0.90	NS	4.50	7
√ Cucurbits: Overall Application Parameters		**0.90**	**5**	**4.50**	**7**
√ Fruiting vegetables	59639-142	**0.90**	**4**	**3.60**	**7**
Peppers	59639-142	0.90	4	3.60	7
	264-678	0.90	NS	4.50	7
	55260-10	0.90	NS	4.50	7
√ Peppers: Overall Application Parameters		**0.90**	**5**	**4.50**	**7**
Tomatoes	59639-142	0.90	4	3.60	7
	264-678	1.13	NS	5.64	7

Table 3. Use rate for propamocarb on vegetables, Lima beans and x-mass/conifer tree plantations (refer to abbreviations[1]; Type of Application: Aerial, Ground, Band & Chemigation)

Crop / Use Site	EPA Reg. No.	MSR	MNA	MYA	MAI
	55260-10	1.13	NS	5.64	7
√ Tomatoes: Overall Application Parameters		**1.13**	**5**	**5.65**	**7**
Lettuce (head and leaf)	59639-142	1.14	4	3.60	10
	264-678	1.50	NS	6.00	5
	55260-10	1.50	NS	6.00	7
√ Lettuce (head & leaf): Overall Application Parameters		**1.50**	**4**	**6.00**	**7**
√ Lima beans: One Label	264-678	**1.50**	**NS (4)**	**6.00**	**7**
Potatoes	59639-142	1.14	NS	3.60	NS
	264-678	0.90	NS	4.50	7
√ Potatoes: Overall Application Parameters		**0.90**	**5**	**6.00**	**7**
√ Lima Beans: One Label	264-678	**1.50**	**NS (4)**	**6.00**	**7**
√ X-mass/Conifer: One Label	59639-142	**2.70**	**NS (2)**	**5.40**	**7**

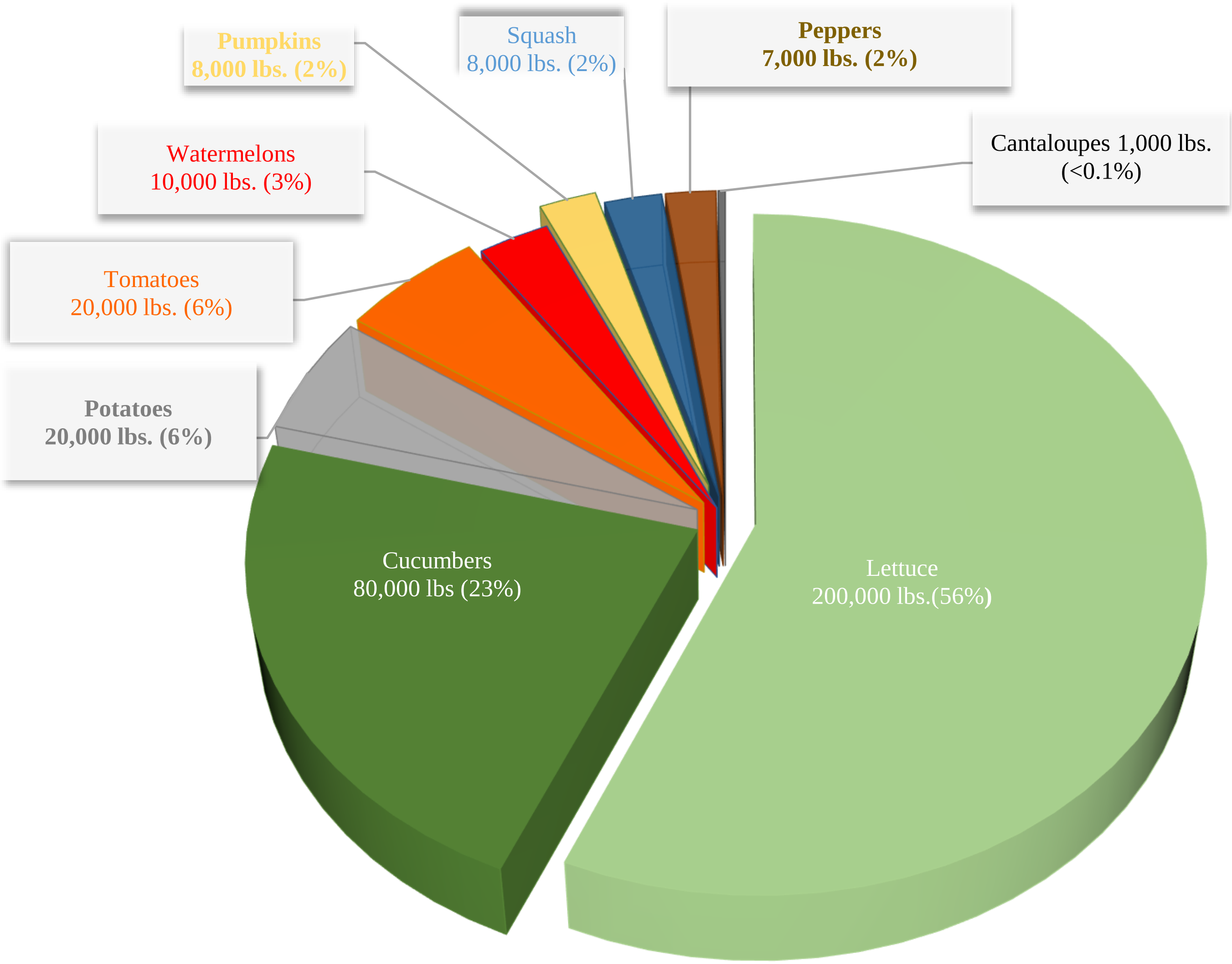
[1] **Abbreviations:** ***MSR*=** Maximum Single Rate (lbs. a.i/A); ***MNA*=** Maximum Number of Applications; ***MYR*=**Maximum Yearly Rate (lbs. a.i/A) assuming yearly rates= seasonal rates; ***MAI*=** Minimum Application Intervals (days); Number in Red is calculated.
√ **Representative *MSR, MNA, MYA and MAI***

2.1.2 Usage Information

A Screening Level Usage Analysis (SLUA, date 11/02/2015) report for propamocarb was provided by Biological and Economic Analysis Division (BEAD). Based on this report, the only usage data were for vegetables and indicated that the annual average of percent of crop treated ranged from <2.50 to 40 and that the maximum percent of crop treated ranged from 5 to 55 (data for ornamental usage and lima bean use was not available).

This amalgamated data were obtained from sources including USDA-NASS (United States Department of Agriculture's National Agricultural Statistics Service) and Private Pesticide Market Research (**Figure 1**). No data is available for usage on turf and nurseries.

Figure 1 2005-2014 National usage of propamocarb on vegetables

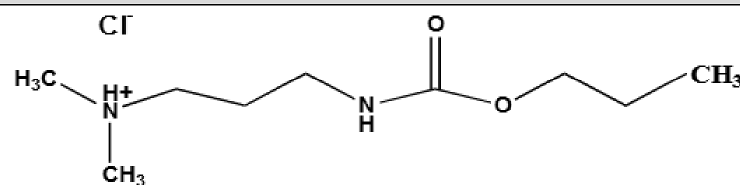


2.2 Environmental Fate and Transport

2.2.1 Chemical Profile

In the environment, propamocarb HCl is expected to readily dissociate into propamocarb. Therefore, the properties for propamocarb will be included and the assessment will cover both propamocarb and its salt. The chemical profile of propamocarb is provided in **Table 4.** Chemical profile of propamocarb.

Table 4. Chemical profile of propamocarb

Property	Value	Reference and Comments
Chemical Structure	 **Smiles Code:** ClN(C)(C)(H)CCCNC(=O)OCCC	
Pesticide type	**Fungicide**	
Chemical class	**Carbamates**	
Molecular Formula	**$C_9H_{20}N_2O_2$ HCl**	
Molecular Weight	**224.73** g/mole	
CAS No.	Propamocarb HCl (salt) **25606-41-1** (Note that Propamocarb CAS No is **24579-73-5**)	
CAS name	Propyl N-[3-(dimethylamino)propyl]carbamate hydrochloride (1:1)	
IUPAC name	Propyl 3-(dimethylamino)propylcarbamate hydrochloride	
Water Solubility (WS) @ 20 ºC	**>700** g/L	Product Chemistry
Dissociation Constant	pKa= **9** (Very weak acid)	MRID 412781-06
Vapor pressure (VP) @ 25 ºC	**6.0×10^{-7}** torr	MRID 433684-09
Henry's Law Constant@ 25 ºC	**2.5×10^{-13}** atm m^3 mol^{-1}	Estimated WS/VP
Octanol/Water Partition Coefficient Log Kow (K_{OW}) @ 25 ºC & pH 7	**-0.39 (0.4)** **& -1.36 (0.044)**	412781-07 & 443049-04

Propamocarb shows a solubility >700 g/L and a K_{OW} of <0.5. These properties suggest that the chemical is highly soluble and that it is unlikely to have the potential to bio-concentrate in aquatic organisms such as fish. The chemical may be characterized as a semi volatile in dry soils as indicated from vapor pressure but low Henry's law constant indicates that the chemical is expected to hardly volatilize from wet soils and water surfaces.

Abiotic Transformation

Propamocarb appears to resist abiotic degradation including: hydrolysis, photolysis in aqueous media and on soils (**Table 5.** Abiotic fate properties for propamocarb).

Table 5. Abiotic fate properties for propamocarb

Property	Values	MRID
Hydrolysis	Stable @ pH 5, 7 and 9	000712-97 (S)
Aqueous Photolysis	Stable: propamocarb does not absorb photo energy in visible region (λ ≥290 nm)	000712-96 (A)
Soil Photolysis	Stable: The chemical does not absorb photo energy in the visible region (λ ≥290 nm) and degradation in samples incubated in the dark > irradiated. Observed degradation in the second study could be attributed to metabolism and presence of un-extracted residue	045893-18 (S) 418346-08 (A)

Biotic Transformation and Transport Properties

Most of the applied propamocarb reaches soil systems directly upon application and later from plant wash-off while other amounts reach aquatic systems upon application via drift and later by run-off waters. Propamocarb residues reaching the soil are expected to be affected by downwards leaching. These processes are covered hereunder by examining the fate of propamocarb in the soil and aquatic systems and its mobility in the soil system.

Metabolism in Soils

Several studies were submitted by the registrant covering propamocarb metabolism in varied aerobic soil systems (**Table 6**).

Table 6. Characteristics of the soils used in submitted aerobic soil studies (application rate for soils 1, 2 and 3= 200 ppm/incubated at 25 ^{O}C; for soils 4, 5, 6 and 7= 250 ppm/incubated at 20 ^{O}C; soil 4LD=10 ppm/incubated at 20 ^{O}C; and soil 4LT=250 ppm/incubated at 10 ^{O}C)

Soil ID	Textural Class	Soil Reaction	pH	O.C %	Clay %	CEC	Half-life (d)
1	Loamy sand	Neutral	6.6	2.4%	5%	11	13
2	Loamy sand	Strongly acidic	5.2	1.1%	4%	5	30
3	Loamy sand	Neutral	6.6	2.3%	7%	Not reported	16

Table 6. Characteristics of the soils used in submitted aerobic soil studies (application rate for soils 1, 2 and 3= 200 ppm/incubated at 25 ^{O}C; for soils 4, 5, 6 and 7= 250 ppm/incubated at 20 ^{O}C; soil 4LD=10 ppm/incubated at 20 ^{O}C; and soil 4LT=250 ppm/incubated at 10 ^{O}C)							
Soil ID	**Textural Class**	**Soil Reaction**	**pH**	**O.C %**	**Clay %**	**CEC**	**Half-life (d)**
4							83
4 LD							66
4 LT	Sandy loam	Neutral	7.1	2.5%	11%	15	124
5	Silt loam	Neutral	6.7	4.5%	20%	18	86
6	Clay loam	Moderately alkaline	8.0	2.7%	34%	22	79
7	Sandy loam	Strongly acidic	5.5	1.3%	12%	11	50

In these nine soil systems, propamocarb degraded into several un-identified degradates (each of which was minor to very minor) and variable amounts of un-identified un-extracted residues (**UER**). **Figure 2** contains a graphical representation for the degradation of propamocarb.

As seen in **Figure 2** parent appears to degrade at variable rates: **soils 1, 3**, **4 LD** & **6** (highest) followed by **soils 2, 4** & **5**; **soil 4 LT**; and **soil 7** (lowest). Parent degradation resulted in:

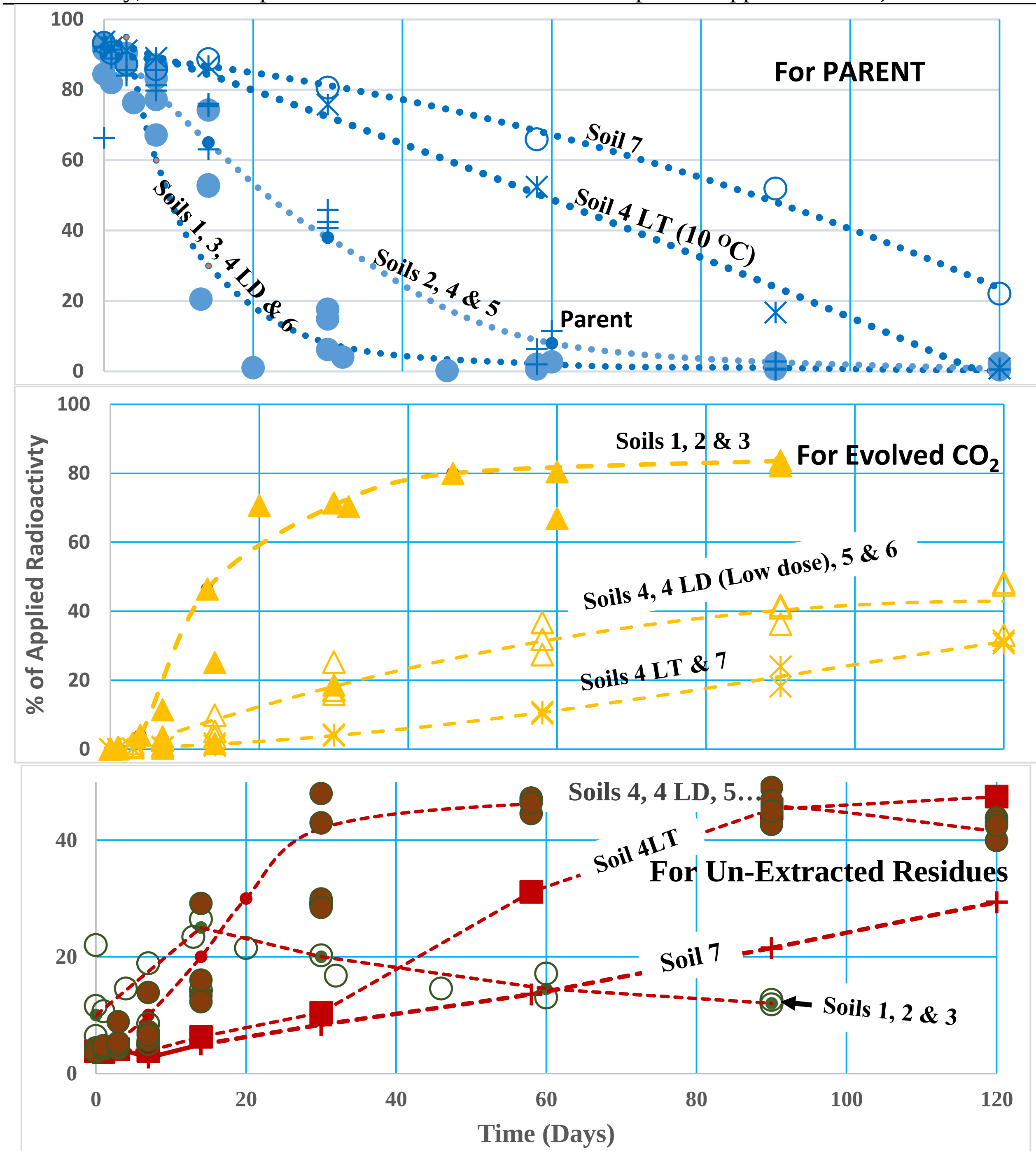
- Formation of several minor degradation products which were not identified but shows a clear decline (not shown in **Figure 2**);

- Formation of CO_2 from mineralization at variable rates: **soils 1, 2** & **3** (highest) followed by **soils 4, 4 LD, 5 & 6**; and **soils 4 LT & 7** (lowest);

- Un-identified un-extracted residues (UER) showing low amounts and clear decline in **soils 1, 2** & **3** with appreciable amounts forming in other soils as follows: **soils 4, 4 LD, 5** & **6** (highest with no or no apparent decline) and **soil 4 LT** (highest with gradual increase and no decline) with lower amounts in **soils 7** (showing gradual increase and no decline); and

- Formation of the UER are directly related to parent biodegradation in both level and timing.

Figure 2. Propamocarb degradation in soils (parent, evolved CO_2 and UER in % of applied radioactivity; dots are reported concentrations while lines represent apparent trends)



The observed UER suggest that appropriate extraction methods were used in **soils 1, 2 and 3** (UER near or <10%) while extractions were probably incomplete in **all other soils** leaving un-extracted parent, other un-known degradate and/or residues incorporated into the soil as un-extracted ot bound residues (UER or Bound)[4]. Following the analysis required by the UER Guidance[5] (**Appendix A**), the following decisions were made:

(1) For **soils 1, 2 and 3**, half-lives may be calculated from parent data alone on the assumption that the <10% amounts of the UER are of no concern (i.e., sink); and

(2) For **soils 4, 4 LD, 4 LT, 5, 6 and 7**, the relatively high amounts of UER may be considered as bound residues a will not be included in calculating the half-lives of the parent. Efforts were executed to extract these residues (refer to Appendix A for more information on the extraction procedures used to attempt to extract the residues).

Fate properties for propamocarb in the aerobic/anaerobic soil systems are summarized in **Table 7**.

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[4] Two terms are used herein, **UER**= Residues left in the soil/sediment following extraction and **Bound residues**= Residues left in soil/sediment that could not be extracted following required extraction attempts as per the UER Guidance.

5 Un-extracted Residues Guidance: URL: http://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/guidance-addressing-unextracted-pesticide-residues http://www.epa.gov/pesticides/science/efed/policy_guidance/team_authors/environmental_fate_tech_team/Unextracted_Residues_in_Lab_Studies.htm

Table 7. Fate of propamocarb in the soil system (test substance: [N-1 OR 2-propyl-^{14}C]-labeled propamocarb for soils		
Property	**Values (Adjusted to 25 ^{o} C)[1]**	**MRID [2]**
Aerobic soil t ½ **Note:** **End of study (*EOS*):** **Soil 1 & 2= 90 d.;** **Soil 3= 46 d.;** **Soils 4, 4LD/LT; 5, 6 & 7= 120 d.**	**13 (13) days (SFO)** in **Soil 1** (Loamy sand from Germany); **30 (30) days (SFO)** in **Soil 2** (Loamy sand from CA); **08 (08) days (SFO)** in **Soil 3** (Loamy sand from Germany; **22 (16) days (SFO)** in **Soil 4** (Sandy Loam from UK); **14 (10) days (SFO)** in **Soil 4 LD** (Sandy Loam from UK); **47 (17) days (SFO)** in **Soil 4 LT** (Sandy Loam from UK); **23 (16) days (SFO)** in **Soil 5** (Silty loam from UK); **18 (13) days (SFO)** in **Soil 6** (Clay loam from UK); and **88 (62) days (SFO)** in **Soil 7** (Sandy loam from UK); **90th percentile t ½= 28 days** (n=9) ***<u>Major Degradates:</u>*** **None** in all Soils ***<u>Minor Degradates:</u>*** **2 to 7 degradates** at concentrations mostly **<1% each** with totals ranging from **<1 to 5%** in **Soils 1** to **3** and from **2 to 14%** in the other soils ***<u>Un-extracted Residues (UER):</u>*** Max 20-29% @ 13-30 d declined to 12-15% @ EOS in **soils 1, 2** & **3**; Max 45-48% @ 30-90 d declined to 40-43% @ EOS in **soils 4, 4 LD, 5** & **6**; Max 48% @ EOS with no decline in **soil 4 LT**; and Max 29% @ EOS with no decline in **soil 7** ***<u>Mineralization to CO_2 (@EOS)</u>*** Ma.x 80-84% in **soils 1, 2** & **3**; Max 45-48% in **soils 4, 5** & **6**; Max 31-33% in **soils 4 LT, 4LD, and 7**	412781-25 (A) **<u>For soil 1;</u>** 412781-26 (S) **<u>For soil 2;</u>** 412781-27 **<u>For soil 3;</u>** **and** 458943-19 (S) **For soil 4, 4LD, 4LT, 5, 6, and 7**
Anaerobic soil t ½ **Note:** **End of study (*EOS*):180 days**	**867 days (DFOP)** in **Soil 1** (Loamy sand from Germany; Same soil above which was used in the aerobic soil study) ***<u>Major Degradates:</u>*** **None** in all Soils ***<u>Minor Degradates:</u>*** **3 degradates** at concentrations **<2% each** with totals ranging from **<1 to 5%** in **Soils 1** to **3** and from **1 to 4%** in the other soils ***<u>Un-extracted Residues (UER):</u>*** Max 8% with variable amounts throughout the study ranging from 4-8% ***<u>Mineralization to CO_2 (@EOS)</u>*** Max 6-8%	412781-29 (S)

Aerobic Aquatic t ½ for Parent; All systems end of study= EOS= 104-105 days @ 20ºC; Noting that systems 1 and 2 were incubated in the dark while systems 3 and 4 were incubated under 8 hours' light/16 hours dark cycle	**21 days (SFO)** in a water/silt loam sediment (**System 1**) from a pond in the UK: water: pH 8.2 and O.C= 30.6 mg/L; sediment: pH=7.7 and O.C= 7.1% **16 days (SFO)** in a water/sand sediment (**System 2**) from a stream in the UK: water: pH 8.3 and O.C= 7.2 mg/L; sediment: pH=8.2 and O.C= 0.3% **18 days (IORE)** in a natural water/sediment "Texture was not reported= NR" (**System 3 OVP**) from the Netherland: water: pH 8.2 and O.C= 45.7 mg/L; sediment: pH= NR and O.C= 1.8% **16 days (IORE)** in a natural water/sediment "Texture was not reported= NR" (**System 4 SW**) from the Netherland: water: pH 9.3 and O.C= 26.5 mg/L; sediment: pH=NR and O.C= 1.9% **90th percentile t ½= 20 days** (n=4) ***<u>Minor Degradates (Un-identified total/All are minor):</u>*** **System 1:** Maximum **5%** at zero d then declined to **2%** @ EOS; **System 2:** Maximum **17%** at 2 d then declined to **2%** @ EOS; **System 4:** Maximum **4%** at zero to 2 d then declined to **1%** @ EOS and **System 4:** Maximum 3**%** at **7** d then declined to **2%** @ EOS ***<u>Un-extracted Residues (UER):</u>*** **Maximums in System 1: 10%** at day 63 then declined to **9%** @ EOS; **System 2: 10%** at 42 d then declined to **7%** @ EOS; **System 3: 15%** at day 42 then declined to **13%** @ EOS and **System 4: 10-12%** from 28 d to EOS ***<u>Mineralization to CO_2:</u>*** **Maximums in System 1: 66%** @ EOS; **System 2: 69%** @ EOS; **System 3**: **80-82%** @ EOS and **System 4**: **90%** @ EOS ***<u>Other Volatiles (not identified):</u>*** **Maximums in System 1: 4%** @ EOS; **System 2: 7%** @ EOS and **in Systems 3 and 4: <0.01%** @ EOS	**487526-03 (S) For Systems 1 and 2** **487526-04 (S) For System 3 and 4**
Anaerobic Aquatic t ½ for Parent: system 1 end of study= EOS= 370 days @ 25 ºC and EOS= 102 days for system 2 @ 20 ºC	**101 days (SFO)** in a water/clay loam sediment (**System 1**) from a pond in NC, USA: water: pH 6.8 and O.C= NR; sediment: pH=5.5; O.C= 4.0% and CEC= 12 meq/100/g. (**Note:** Sand was removed by sieving) **37 days (SFO)** in a water/loamy sand sediment (**System 2**) from a pond in CA, USA: water: pH 8.0 and O.C= 5.1 mg/L; sediment: pH=7.6; O.C= 0.24% and CEC= 7 meq/100/g. **90th percentile t ½= 168 days** (n=2) ***<u>Minor Degradates (Un-identified total/All are minor in System 1 but was not separated in System 2):</u>*** **System 1: Max 14%** at 13 d then declined to **2%**; **System 2:** Max **15%** at 95 d then declined to **3%** @ EOS	**445385-04 (S) For System 1** **459711-01 (S) For Systems 2**

	Un-extracted Residues (UER): **Max in System 1: 18%** at 110 d then declined to 6% @ EOS; **System 2:** Max **10%** at 13 d then declined to **5%** @ EOS ***Mineralization to CO_2* @ EOS :** **Max in System 1: 68%**; and in **System 2: 43%** ***Other Volatiles (Methane):*** **System 1: None detected**; **System 2: 6%** @ EOS	
	NY on Turf: Dissipation Half-life (top 8 cm): **10** days; noting that no data were submitted for dissipation of the chemical in various turf layers (Grass, thatch, and soil) **Leaching**: parent detected up to the maximum depth monitored (90 cm) @ day 2 with a maximum of nearly 10% Therefore, the extent of **parent leaching may have been below 91 cm**	
	CA on Turf: Dissipation Half-life (top 8 cm): **15** days **Leaching**: parent **was not detected below 46 cm at any day after last application**	424212-02 (S)
	IL on Bare plots: Dissipation Half-life (top 15 cm): Biphasic with **7** days half-life for the fast phase and **165** days for the slow phase **Leaching**: Parent **was not detected below 30 cm at any after last application**	
	NC on Bare plots: Dissipation Half-life (top 15 cm): Biphasic with **23** days half-life for the fast phase and **187** days for the slow phase **Leaching**: Parent **was not detected below 30 cm at any day after last application**	440016-01 (S)
	CA on Bare plots: Dissipation Half-life (top 15 cm): **22** days **Leaching**: Parent **was not detected below 30 cm at any day after last application**	
	GA on Bare plots: Dissipation Half-life (top 15 cm): **18** days, observed bi-phasic with <5 day half-life for the 1st degradation phase **Leaching**: Parent **was not detected below 30 cm at any day after last application**	
	CA on Turf: Grass: Dissipation DT_{50}= 18 days; Thatch: Dissipation DT_{50}= 23 days; **Soil: Dissipation DT_{50}= 18 days)** **Leaching:** Parent **was not detected below 45 cm at any day after last application**	
Terrestrial Field Dissipation Studies	**GA on Turf: Grass: Dissipation DT_{50}= 18 days**; **Thatch: Dissipation DT_{50}= 18 days;** **Soil: Dissipation DT_{50}= 13 days** **Leaching**: Parent **was not detected below 15 cm at any day after last application**	458943-22 (S)
K_{foc} ((L Kg^{-1})	**2,494** for a **Clay loam** soil from Minnesota (OC= 3.15%, pH= 5.8, CEC= 24 meq/100 g) **202** for a **silt loam** soil from Germany(OC= 1.3%, pH= 7.4, CEC= 13 meq/100 g) **134** for a **Sandy loam** soil from UK (OC= 1.86%, pH= 7.4, CEC= 18 meq/100 g)	**487526-01 (A)**

	131 for a **Silty loam** soil from Germany (OC= 1.04%, pH= 5.8, CEC= 8 meq/100 g) **633** for a **Loamy clay** soil from Germany (OC= 1.57%, pH= 6.4, CEC= 30 meq/100 g)	
	140 for a **sandy** soil from Germany (OC= 0.50%, pH= 6.0, CEC= 4 meq/100 g) **41** for a **Loamy sand** soil from Germany (OC= 2.1%, pH=6.0, CEC= 8 meq/100 g) **359** for a **Sandy loam** soil from Germany (OC= 1.50%, pH= 5.2, CEC= 13 meq/100 g)	**412781-30 (S)**
	57 for a L**oamy sand** soil from Germany (OC= 2.27%, pH= 6.1, CEC= 9 meq/100 g) **180** for a **Sandy clay loam** soil from the UK (OC= 3.49%, pH= 6.5, CEC= 34 meq/100 g) **1,317** for a **Sandy loam** soil from Nebraska (OC= 1.05%, pH= 5.7, CEC= 11 meq/100 g) **802** for a **Loamy sand** soil from Nebraska (OC= 0.58%, pH= 5.9, CEC= 6 meq/100 g)	**458943-21 (S)**
	180, 458, 594, 3,900 in a European soil sampled at four depths: 20, 40, 60, and 90 cm characterizes as follows: **Sandy loam:** O.C 0.56%, pH 6.29; **Loamy sand:** O.C 0.24%, pH 6.34; **Sand:** O.C 0.18%, pH 6.37; and **Sand:** O.C 0.02%, pH 6.40; Respectively **Average: 726** (n=16)	**487526-02 (A)**
Fish Accumulation (BCF)	The chemical did not significantly accumulate in bluegill sunfish exposed at 1.0 ppm for 28 days. Maximum bioconcentration factors were **1.5X** in edible tissues and **3.0 X** in non-edible tissues. Depuration was rapid, with residues not detectable in the fish tissues by days 7-10 of the depuration period	**412781-14 (S)** **And** **931930-41 (S)**
[1] **SFO=** Single first orde**r; DFOP=** Double First Order in Parallel and **IORE=** Indeterminate Order Rate Equation [2] **Study Classification: A= Acceptable and S= Supplemental** [3] **Static systems** were used for the three soils in addition to using a **flow through system** for **the 4th soil**		

Fate data for propamocarb suggest that the chemical is stable to abiotic hydrolysis and photolysis and that the main route of degradation is through aerobic soil/aquatic systems metabolism. Degradation in anaerobic soil/aquatic systems is substantially less than in aerobic conditions. A significant part of the parent degradation appears to be related to mineralization to CO_2. Residues from propamocarb degradation consists of 2-7 minor un-identified degradates and in some soil significant amounts of un-extracted residues (UER= 20-48%) that declines to nearly 12-15% in some of these soils. These UER are considered bound residues.

2.3 Aquatic Exposure Modeling Approach

EECs of propamocarb in surface water, pore water and sediment were generated based on maximum labeled single and annual use rates among many other parameters. Given the assumed binding for propamocarb or any of its unknown degradate(s) and its likelihood to occur in sediment, the Agency also considered the potential exposures resulting from benthic (pore water and sediment) concentrations (EECs). Pore-water concentrations are commonly used to predict toxicity of non-ionic substances in sediments and characterize exposure to organisms that spend time in or near sediments (Di Toro *et al.* 1991; US EPA 2002).

Surface water, pore water and sediment EECs were generated using Tier II aquatic model PRZM/VVWM (SWCC, v.1.106, May 6, 2014)[6]. The model is a graphical user interface used to facilitate inputting chemical and use specific parameters into the appropriate input files and chemical files. The SWCC estimates pesticide concentrations in water bodies that result from pesticide applications to land. More information on models used for aquatic exposure are present in the Agency website[7].

2.3.1 Modeling Inputs

The following steps were taken for modeling using the SWCC model:

Step 1: Selection of use patterns, application parameters and scenarios: Based on the use patterns of propamocarb, required parameters were obtained/summarized in **Table 8**.

Table 8. Modeled use patterns for propamocarb based on expected high exposure for each use pattern/application type (Refer to Abbreviations, below[1])

	Application Window[2]					
Use Pattern	**Width**	**Steps**	**Representative Scenario**	**MSR (kg/ha)**	**MNA**	**MAI**
Beans, Lima (Aerial/Ground application as foliar w/ drift; Modeled aerial only because aerial higher exposure)	70	14	ILbeansNMC MIbeansSTD	**1.68**	**4**	**7**
Cucurbits (Same as Beans)	70	14	CAMelonsRLF FLcucumberSTD MImelonStd MOmelonStd NJmelonStd STXmelonNMC	**1.01**	**5**	**7**
Fruiting vegetables: Tomatoes & Others	70	14	CAtomato_WirrigSTD FLtomatoSTD_V2 PAtomatoSTD	**1.27**	**5**	**7**
Fruiting vegetables: Pepper	70	14	FLpeppersSTD	**1.01**	**5**	**7**
Lettuce: Leaf & Head	70	14	CAlettuceSTD	**1.68**	**4**	**7**
	160	14	CAnurserySTD_V2			

[6] Modeling runs were executed just before the release of the new version of the model, the pesticide water calculator (PWC version 1.52) and there is no need to execute new runs because the new version is expected to give similar results.

[7] URL: https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/models-pesticide-risk-assessment

Table 8. Modeled use patterns for propamocarb based on expected high exposure for each use pattern/application type (Refer to Abbreviations, below[1])						
	Application Window[2]		**Representative Scenario**	**MSR (kg/ha)**	**MNA**	**MAI**
Use Pattern	**Width**	**Steps**				
Ornamentals: Seeding/Seedling; Nursery stock; Transplant Cutting; Woody shrubs & Vines and potted plants **(**Ground application as foliar spray; with drift)			FLnurserySTD_V2 MInurserySTD_V2 NJnurserySTD_V2 ORnurserySTD_V2 TNnurserySTD_V2	**72.08**	**2**	**7**
Ornamentals: Seeding/Seedling; Nursery stock; Transplant Cutting; Woody shrubs & Vines and potted plants (Ground application as soil drench; no drift)	160	14	CAnurserySTD_V2 FLnurserySTD_V2 MInurserySTD_V2 NJnurserySTD_V2 ORnurserySTD_V2 TNnurserySTD_V2	**72.08**	**2**	**7**
Potatoes (Aerial/Ground application as foliar with drift; Modeled aerial only because aerial exposure is higher)	120	14	CAPotatoRLF_V2 FLpotatoNMC IDNpotato_WirrigSTD MEpotatoSTD WApotatoNMC	**1.01**	**5**	**7**
Turf: Lawns, Turf and Sod farms (Ground application as foliar spray with drift; No aerial application allowed)	160	14	CATurfRLF FLturfSTD PAturfSTD	**9.19**	**3**	**7**
X-mass/Conifer Tree plantations (Same as Beans)	160	14	CAForestryRLF ORXmasTreeSTD	**3.03**	**2**	**14**

[1] **Abbreviations:** ***MSR*=** Maximum Single Rate (lbs. a.i/A); ***MNA*=** Maximum Number of Applications; ***MYR*=**Maximum Yearly Rate (lbs. a.i/A) assuming yearly rates= seasonal rates; ***MAI*=** Minimum Application Intervals (days)

[2] **Window of Application**: Each run starts with 1st application at 7 days following crop emergence; 2nd at 7+ ***MAI*** and so on up to the last application. This process is repeated within the width of the window specified above at the steps specified above

Step 2: Selection propamocarb chemical parameters needed for modeling: Selected parameters were as per the parameter guidance[8] and is summarized in **Table 9**.

Table 9. Summary of input parameters for modeling propamocarb		
Input Parameter (Unit)	**Value**	**References**
Koc (Average in L/Kg)	**726**	MRIDs: 412781-30; 458943-21; 487526-01/02
Aerobic Aquatic (t½ in days @ 20 ºC)	**20**	90th percentile (n=4; MRIDs: 487526-03 & 487526-04
Anaerobic Aquatic (t½ in days @ 20 ºC)	**168**	90th percentile of two values (MRIDs: 445385-04 & 459711-01
Photolysis in Water (t½ in days @ pH 7)	**Stable**	MRID 000712-96
Hydrolysis (t½ in days)	**Stable**	MRID 000712-97
Aerobic Soil (t½ in days @ 25 ºC)	**28**	MRIDs 412781-25; 412781-26; 412781-27 & 458943-19
Molecular Weight g/mole	**224.73**	Product chemistry
Vapor pressure (VP) torr @ 25 ºC	**6.0×10^{-7}**	MRID 433684-09
Solubility in Water(mg/L)	**700,000**	Product chemistry
Application Efficiency	**99%** for ground; **95%** for Air; **100%** for Drench	
Spray Drift Fraction	**Ground= 0.066; Air= 0.135; Drench= 0.00**	
Percent Crop Area (PCA)	**100%**	**Multiple crops including ornamentals PCA Guidance[9]**

2.3.2 Modeling Results

A total of 309 model simulations were executed using the batch feature of the model and the results are summarized in **Table 10**.

[8] SWCC model input guidance URL: https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/guidance-selecting-input-parameters-modeling

[9] Development and Use of Percent Cropped Area and Percent Turf Area Adjustment Factors in Drinking Water Exposure Assessments: 2012 Update.
URL: http://www.epa.gov/oppefed1/models/water/pca_adjustme.t_dwa.pdf

Table 10. Summary of surface water EECs resulting from current propamocarb labeled uses (maximums are bolded)								
Use Pattern	**Representative Scenario (days from emergence)**	**Water Column (µg/L)**			**Pore-Water (µg/L)**		**Sediment (µg/kg)**	
		Peak	**21-d**	**60-d**	**Peak**	**21-d**	**Peak**	**21-d**
Beans, Lima	ILbeansNMC (+42)	56	36	26	18	18	529	523
	MIbeansSTD (+42)	59	44	33	22	22	650	644
Beans, Lima		**59**	**44**	**33**	**22**	**22**	**650**	**644**
Cucurbits	CAMelonsRLF (+42)	16	12	8	4	4	131	128
	FLcucumberSTD (+42)	48	37	24	15	15	432	426
	MImelonStd (+42)	44	27	17	11	11	318	312
	MOmelonStd (+42)	54	33	21	13	13	379	370
	NJmelonStd (+42)	45	31	18	11	11	318	312
	STXmelonNMC (+56)	79	47	27	17	17	500	488
Cucurbits		**79**	**47**	**27**	**17**	**17**	**500**	**488**
Fruiting vegetables: Tomatoes & Others	CAtomato_WirrigSTD (+28)	30	24	18	11	10	312	306
	FLtomatoSTD_V2 (+42)	72	52	36	21	21	623	612
	PAtomatoSTD (+42)	53	38	23	18	17	515	503
Pepper	FLpeppersSTD (+28)	90	59	34	20	21	594	606
Fruiting vegetables		**90**	**59**	**36**	**21**	**21**	**623**	**612**
Lettuce: Leaf & Head	CAlettuceSTD (+14)	51	39	32	19	19	567	564
Lettuce: Leaf & Head		**51**	**39**	**32**	**19**	**19**	**567**	**564**
Ornamentals: Seeding/Seedling; Nursery stock; Transplant Cutting; Woody shrubs & Vines /potted plants: Foliar	CAnurserySTD_V2 (+20)	684	471	326	204	202	5,998	5,939
	FLnurserySTD_V2 (+80)	2,150	1,300	708	414	406	12,172	11,936
	MInurserySTD_V2 (+120)	616	491	363	228	225	6,703	6,615
	NJnurserySTD_V2 (+80)	1,220	923	661	391	388	11,495	11,407
	ORnurserySTD_V2 (+100)	506	374	265	154	153	4,528	4,498
	TNnurserySTD_V2 (+80)	1,250	823	476	281	276	8,261	8,114
Ornamentals (Foliar)		**2,150**	**1,300**	**708**	**414**	**406**	**12,172**	**11,936**
Ornamentals: Seeding/ Seedling; Nursery stock; Transplant Cutting; Woody shrubs & Vines /potted plants: Drench	CAnurserySTD_V2 (+20)	166	117	71	41	41	1,202	1,191
	FLnurserySTD_V2 (+80)	1,610	977	515	296	290	8,702	8,526
	MInurserySTD_V2 (+120)	314	245	166	110	109	3,234	3,205
	NJnurserySTD_V2 (+80)	781	591	411	245	242	7,203	7,115
	ORnurserySTD_V2 (+100)	134	97	70	41	40	1,194	1,185
	TNnurserySTD_V2 (+80)	873	592	341	197	194	5,792	5,704
Ornamentals (Drench)		**873**	**592**	**411**	**245**	**242**	**7,203**	**7,115**
Potatoes	CAPotatoRLF_V2 (+28)	22	17	13	8	8	227	224
	FLpotatoNMC (+0)	43	34	26	17	17	497	491
	IDNpotato_WirrigSTD (+14)	25	20	14	9	9	260	256
	MEpotatoSTD (+28)	31	25	19	16	16	476	470
	WApotatoNMC (+42)	19	15	11	7	7	194	191
Potatoes		**43**	**34**	**26**	**17**	**17**	**497**	**491**

Table 10. Summary of surface water EECs resulting from current propamocarb labeled uses (maximums are bolded)								
Use Pattern	**Representative Scenario (days from emergence)**	**Water Column (µg/L)**			**Pore-Water (µg/L)**		**Sediment (µg/kg)**	
		Peak	**21-d**	**60-d**	**Peak**	**21-d**	**Peak**	**21-d**
Turf: Lawns, Turf and Sod farms	CATurfRLF (+ 70)	78	61	43	26	25	753	747
	FLturfSTD (+42)	94	68	42	24	24	706	691
	PAturfSTD (+112)	97	62	40	27	26	782	776
Turf: Lawns, Turf and Sod farms		**97**	**68**	**43**	**27**	**26**	**782**	**776**
X-mass/Conifer Tree plantations	CAForestryRLF (+70)	26	21	18	12	12	353	350
	ORXmasTreeSTD (+126)	16	11	8	5	5	142	141
X-mass/Conifer Tree plantations		**26**	**21**	**18**	**12**	**12**	**353**	**350**

2.4 Monitoring

There is no readily available monitoring data for this chemical. Propamocarb was not found in the USGS National Water Quality Assessment Data Warehouse (NAWQA), when verified by constituent finder (at http://waterqualitydata.us/portal/ accessed 10/03/2016).

2.5 Terrestrial Exposure Modeling Approach

2.5.1 Exposure to Birds and Mammals

Terrestrial wildlife exposure estimates are typically calculated for birds and mammals by emphasizing the dietary exposure route of uptake of pesticide active ingredients. These exposures are considered to be surrogates for exposures to terrestrial-phase amphibians and reptiles. For exposures to terrestrial organisms, such as birds and mammals, pesticide residues on food items are estimated based on the assumption that organisms are exposed to pesticide residues as a function of the pesticide use pattern.

T-REX (v. 1.5.2) is used to calculate dietary and dose-based EECs of propamocarb residues on food items for mammals and birds generated by spray applications for the labeled uses. Input values for deriving EECs using T-REX are located in **Table 11.** Input Parameters for deriving terrestrial EECs for labeled uses of propamocarb (T-REX v. 1.5.2).Upper-bound Kenaga nomogram values are used to derive EECs for propamocarb exposures to terrestrial mammals and birds based on a 1-year time period. Consideration is given to different types of feeding strategies for mammals, including herbivores, insectivores and granivores. Dose-based exposures are estimated for three weight classes of birds (20 g, 100 g, and 1000 g) and three weight classes of mammals (15 g, 35 g, and 1000 g). Terrestrial EECs for foliar spray uses of propamocarb are provided in Error! Reference source not found.**,** Table 13**,**Table 14**.**

It should be noted that the modeled rate used for ornamentals can be used as a ground spray or as a Trench method. T-REX is currently unable to simulate a drench application methods and thus was not modeled for terrestrial organisms.

Table 11. Input Parameters for deriving terrestrial EECs for labeled uses of propamocarb (T-REX v. 1.5.2).			
Uses Represented	**Single App Rate (lb a.i./A)**	**Max No. of Apps at Max Rate**	**Min. Interval Between Apps (days)**
Turf	8.2	3	7
Ornamentals	64.3	2	7
Cucurbits; Peppers; Potatoes[1]	0.90	5	4.50
Fruiting Vegetables	0.90	4	7
Tomatoes	1.13	5	7
Lettuce; Lima beans[2]	1.50	4	7
Conifer	2.70	2	7
[1]Herein, curcurbits will be used to represent peppers and potatoes, as they have identical application methods [2] Herein, Lettuce will be used to represent lima beans, as they have identical application methods			

N/A = not applicable

Differences in exposures between ground and aerial applications cannot be assessed with the current T-REX model; exposure and risk estimates from the T-REX model are considered relevant to both application scenarios. Other uncertainties in the terrestrial EECs are primarily associated with a lack of data on interception and subsequent dissipation from foliar surfaces. EFED assumes a default 35-day foliar dissipation half-life, based on the work of Willis and McDowell (1987) when data are absent or are insufficient.

Table 12. Dose-based EECs (mg/kg bw) as food residues for birds, reptiles, and terrestrial-phase amphibians from labeled uses of propamocarb (T-REX v. 1.5.2).

Primary Feeding Strategy →	Herbivores and Omnivores												Insectivores			Granivores		
Animal Size →	Small				Med				Large				Small	Med	Large	Small	Med	Large
Dietary Items → / Use(s)[1] ↓	**Short Grass**	**Tall Grass**	**Broad-leaf Plants**	**Fruits, pods, seeds,**	**Short Grass**	**Tall Grass**	**Broadleaf Plants**	**Fruits, pods, seeds,**	**Short Grass**	**Tall Grass**	**Broadleaf Plants**	**Fruits, pods, seeds,**	**Arthropods**			**Seeds, grains, *etc*.**		
Turf	5891	2700	3313	368	3359	1539	1889	210	1504	689	846	94.0	2307	1315	589	81.8	45.7	20.9
Ornamentals	32875	15068	18492	2054	18747	8592	10545	1171	8393	3846	4721	524	12876	7342	3287	456	260	116
Cucurbits	950	435	534	59.4	541	248	304	33.9	242	111	136	15.2	372	212	95.0	13.2	7.5	3.4
Fruiting Vegetables	808	370	455	50.6	461	211	259	28.8	207	94.7	116	12.9	317	181	81.0	11.2	6.4	2.9
Tomatoes	1193	549	671	74.6	680	312	383	42.5	305	140	171	19.0	467	266	119	16.6	9.5	4.2
Lettuce	1348	618	758	84.2	769	352	432	48.1	344	158	194	21.5	528	301	135	18.7	10.7	4.8
Conifer	1380	633	777	86.2	787	361	443	49.2	352	162	198	22.0	541	308	138	19.2	10.9	4.9

Table 13. Dose-based EECs (mg/kg bw) as food residues for mammals from labeled uses of propamocarb (T-REX v. 1.5.2).

Primary Feeding Strategy →	Herbivores and Omnivores												Insectivores			Granivores		
Animal Size →	Small				Med				Large				Small	Med	Large	Small	Med	Large
Dietary Items → / Use(s)[1] ↓	**Short Grass**	**Tall Grass**	**Broad-leaf Plants**	**Fruits, pods, seeds, *etc*.**	**Short Grass**	**Tall Grass**	**Broadleaf Plants**	**Fruits, pods, seeds, *etc*.**	**Short Grass**	**Tall Grass**	**Broadleaf Plants**	**Fruits, pods, seeds, *etc*.**	**Arthropods**			**Seeds, grains, *etc*.**		
Turf	4931	2260	2774	208	3408	1562	1917	213	790	362	444	49.3	1931	1335	309	68.5	47.3	10.9
Ornamentals	27521	12614	15481	1720	19021	8718	10699	1188	4410	2021	2480	275	10779	7449	1727	382	264	61.3
Cucurbits	795	364	447	49.7	550	252	309	34.4	127	58.4	71.7	8.0	311	215	49.9	11.0	7.63	1.77
Fruiting Vegetables	677	310	380.9	42.3	468	214	263	29.3	108	49.7	61.0	6.8	265	183	42.5	9.4	6.5	1.5
Tomatoes	999	456	562	62.4	690	316	388	43.1	160	73.4	90.0	10.0	391	270	62.7	13.8	9.6	2.2
Lettuce	1129	517	635	70.1	780	358	439	48.8	181	82.9	101	11.3	442	306	70.8	15.7	10.8	2.5
Conifer	1156	530	650	72.2	799	366	449	49.9	185	84.9	104	11.6	453	313	72.5	16.0	11.1	2.6

Table 14. Dietary-based EECs (mg/kg diet) as food residues for birds, reptiles, terrestrial-phase amphibians, and mammals from labeled uses of propamocarb (T-REX v. 1.5.2).					
Primary Feeding Strategy →	**Herbivores, Omnivores, and Granivores**				**Insectivores**
Dietary Items → / **Use(s) ↓**	**Short Grass**	**Tall Grass**	**Broad-leaf Plants**	**Fruits, pods, seeds, *etc.***	**Arthropods**
Turf	5172	2370	2909	328	2025
Ornamentals	28866	12230	16237	1804	11306
Cucurbits	834	382	469	52.1	326.8
Fruiting Vegetables	710	325	399	44.4	278
Tomatoes	1047	480	589	65.5	410
Lettuce	1183	543	666	74.0	464
Conifer	1212	556	682	75.8	475

2.5.2 Exposure to Bees

Estimating risks to bees associated with the proposed uses of propamocarb follows OPP's recently published guidance entitled: *"Guidance for Assessing Pesticide Risks to Bees*[10]*."* This guidance presents an iterative, tiered process for assessing risks that considers multiple lines of evidence related to exposure and effects of pesticides to bees.

Potential for Pesticide Exposure of Bees

The first step in this process involves a qualitative assessment of the potential for exposure of bees to the pesticides. This exposure potential is a function of the application method, timing, location (*e.g.*, indoor vs. outdoor), attractiveness of the crop to bees, agronomic practices (*e.g.*, timing of harvest), and the availability of alternative forage sources. For informing the potential for exposure of bees to propamocarb on the treated site, information on the attractiveness of crops was considered based on EFSA[11] and USDA[12] compilations. **Table 15** provides a summary of information on the bee attractiveness of the crops proposed for propamocarb applications. Proposed crops which are considered attractive to honey bees, bumble bees and/or solitary bees include cotton, which is noted to be attractive for its nectar sources. For ornamentals, turf and fruiting vegetables, the attractiveness to bees is uncertain given the variability of these species producing pollen and nectar that bees would find attractive.

10 http://www2.epa.gov/sites/production/files/2014-06/documents/pollinator_risk_assessment_guidance_06_19_14.pdf
11 http://www.efsa.europa.eu/en/search/doc/3295.pdf
12 USDA. 2015. Attractiveness of Agricultural Crops to Pollinating Bees for the Collection of Nectar and/or Pollen. Draft. January 13.

Table 15. Attractiveness of crops registered for propamocarb application to bees			
Crop Name	**Honey Bee Attractive?**	**Bumble Bee Attractive?**	**Solitary Bee Attractive?**
Ornamentals	Uncertain		
Turf	Uncertain		
Cucurbits	Pollen (Yes) Nectar (Yes)	Yes	Yes
Fruiting Vegetables	Uncertain		
Peppers	Pollen (Yes) Nectar (No)	Yes	Yes
Tomatoes	Pollen (No) Nectar (No)	Yes	Yes
Lettuce	Pollen (Yes) Nectar (Yes)	Yes	Yes
Lima beans	Pollen (Yes) Nectar (Yes)	Yes	No
Potatoes	Pollen (No) Nectar (No)	Yes	Yes

For crop uses where an exposure potential of bees is identified, the next step in the risk assessment process is to conduct a Tier 1 risk assessment. By design, the Tier 1 assessment relies on conservative (high end) estimates of exposure via contact and oral routes. For contact exposure, only the adult (forager) life stage is considered since this is the relevant life stage for honey bees. Effects are defined by laboratory exposures to groups of individual bees. As discussed in the terrestrial toxicity section, the acute contact toxicity LD_{50} to adult honey bees is >100 µg ai/bee.

2.5.3 Runoff and spray drift to terrestrial and semi-aquatic plants

Exposure of non-target terrestrial and semi-aquatic (wetland) plant species is estimated using the TerrPlant (v. 1.2.2) model. Loading via spray drift to dry, non-target, adjacent areas is assumed to occur from one acre of treated land to one acre of the non-target area. Runoff is also expected to be a source of pesticide loading to non-target areas. TerrPlant calculates EECs as a function of application rate, solubility, and default assumptions regarding spray drift. The default spray drift assumptions are 1% of the application rate for ground spray applications and 5% for aerial spray applications (USEPA 2006b). The EECs for terrestrial and semi-aquatic plants for a single application of propamocarb at the maximum labeled rates for representative uses are presented in

Table 16. An effort was made to bound the estimates of toxicity to terrestrial plants; in addition to the modeling the two maximum application rates, the lowest rate was modeled. The results of this will show the range of EECs for propamocarb.

Table 16. EECs for terrestrial and semi-aquatic plants near propamocarb use areas (TerrPlant v. 1.2.2).						
Use	**Single Max. Application Rate (lbs a.i./A)**	**EECs (lbs a.i./A)**				
		Runoff to dry areas	**Runoff to semi-aquatic areas**	**Spray drift**	**Total for dry areas**	**Total for semi-aquatic areas**
Ornamentals Aerial	64.3	3.2	21	3.2	6.4	35
Ornamentals Ground	64.3	3.2	32	0.64	3.9	33
Turf Aerial	8.2	0.41	4.1	0.41	0.82	4.5
Cucurbits Aerial	0.90	0.045	0.45	0.045	0.090	0.50

[NA] Not applicable.

3.0 Ecological Toxicity

Assessment endpoints represent the actual environmental value that is to be protected, defined by an ecological entity (species, community, or other entity) and its attribute or characteristics (EPA 1998). For propamocarb, the ecological entities include the following: birds, reptiles, terrestrial-phase amphibians, mammals, freshwater fish, freshwater aquatic-phase amphibians and invertebrates, estuarine/marine fish and invertebrates, terrestrial plants, insects, aquatic plants, and algae. The attributes for each of these entities include growth, reproduction, and survival.

The ecological effects characterization for propamocarb is based upon registrant-submitted toxicity data for the TGAI (parent compound) and for specified formulations. The ecotoxicity data for propamocarb and its associated products have been reviewed previously in multiple ecological risk assessments and in the Problem Formulation for Registration Review assessment (USEPA 2011). Various studies with terrestrial and aquatic plants, birds, and aquatic animals exposed to either the TGAI or formulated propamocarb have been received since the Problem Formulation was issued; the results of these studies are described briefly in this section.

A majority of the studies cited in this section are classified as supplemental on the basis of test material used in the study. All registered propamocarb products are 66-67% ai; there is not technical ingredient, thus most of these studies were conducted with the formulated products Previcur and ProPlant. Based on communication with the registrant, the formulated products and the TGAI can be considered to be identical, thus, while these studies are classified as supplemental based on the test material used, this is not considered to be a significant deviation.

3.1 Aquatic Organism

Propamocarb exposure effects on aquatic organisms were determined by assessing freshwater fish, freshwater invertebrates, marine/estuarine fish, marine/estuarine invertebrates, marine/estuarine mollusks, and aquatic plants. No data is available for marine/estuarine invertebrates or fish on a chronic basis. A brief summary of the individual studies, cited in **Table 17**, which are representative of the most sensitive endpoints, can be found in the proceeding sections

Table 17. Most sensitive endpoints for aquatic species

Test Species	Study Duration; exposure system	Endpoint (95% CL; slope)	Acute Toxicity Classification/Affected Endpoint (MRID)	Guideline; Acceptability
Rainbow trout *(Onchorhynchus mykiss*)	96-hour; static	96-h LC_{50} > 99 ppm	Slightly toxic to practically non-toxic[2] (42083103)	850.1075; Supplemental/Quantitative
Fathead minnow *(Pimephales promelas*)	32-day; early life stage	NOAEC = 6.3 ppm LOAEC = 13 ppm	Reduced dry weight (42083105)	850.1400; Supplemental/Quantitative
Water flea (*Daphnia magna*)	48-hr; flow-through	48-hr EC_{50} >103.4 ppm	Practically non- toxic[2] (45894303)	850.1010; Supplemental/Quantitative
Water flea (*Daphnia magna*)	21-day Life Cycle, static renewal	NOAEC = 9.3 ppm LOAEC = 19 ppm	Reduced dry weight(45727801	850.1300; Acceptable
Sheepshead minnow (*Cyprinodon variegatus*)	96-hour, flow-through	96-h LC_{50} > 96.8 ppm	Slightly toxic to practically non-toxic[2] (41834603)	850.1075; Supplemental/Quantitative
Sheepshead minnow	34-day early life stage, flow through	No data available; study waived[1]		
Mysid shrimp *(Americamysis bahia)*	96-hour, flow-through	96-hr LC_{50} = 50.5 ppm	Slightly toxic (45894306)	850.1035; Supplemental/Quantitative
Eastern Oyster *(Crassostrea virginica)*	96-hour, flow through	96-hour EC_{50} = 39.2 ppm	Slightly toxic (42083104)	850.1025 Supplemental/Quantitative
Mysid shrimp (*Daphnia magna*)	28-day Life Cycle, flow through	No data available; study waived[1]		
Duckweed *(Lemna gibba)*	14-day, static renewal	14-d EC_{50} =172 ppm 14-d NOAEC= 476 ppm 14-d LOAEC 476	Biomass (45894313)	850.4400; Acceptable
Green Algae *(Selenastrum capricornutum)*	5-day, static renewal	5-d EC_{50} > 170 ppm 5-d NOAEC = 71 ppm 5-d LOAEC = 130	Cell Density (45894312)	850.4500; Supplemental/Quantitative

[1] Additional information concerning why these study requirements were waived can be found in D413347

Table 17. Most sensitive endpoints for aquatic species				
Test Species	**Study Duration; exposure system**	**Endpoint (95% CL; slope)**	**Acute Toxicity Classification/Affected Endpoint (MRID)**	**Guideline; Acceptability**
[2] These acute study classifications are standardly applied to studies; however these are non-definitive endpoints that had no mortalities thus the study classification may be misleading				

3.1.1 Freshwater Fish Toxicity

There are two acute freshwater fish toxicity studies available for propamocarb: MRID 42083103 and 42083102. Both endpoints presented in these studies were non-definitive, greater than values ranging from > 92 ppm to 99 ppm. In 42083103, conducted using propamocarb, technical, on the rainbow trout, there were no mortalities observed, nor were any sublethal effects reported for the test duration. This toxicity test is a limit test that dosed the organisms at 100 mg/L with a nominal concentration of 99 mg/L. There were no other mortalities or sublethal effects listed in the study. Based on the results of this examination, propamocarb is classified as slightly toxic to freshwater fish on an acute basis.

There is one early life stage toxicity study available for propamocarb: MRID 42083105. This study was conducted using the fathead minnow and showed no treatment related effects on percent hatching effects at all treatment levels. The treatment levels for this test were defined as 3.5, 6.3, 12, 25 and 51 ppm. Fish wet weight and length at the top two concentrations were significantly reduced when compared to the control; fish dry weigh in the top three concentrations were significantly reduced when compared to the control. The NOAEC and LOAEC based on reduced dry weight were 6.3 ppm and 13 ppm.

3.1.2 Freshwater Invertebrate Toxicity

In a static acute toxicity study with *Daphnia magna* (MRID 45894303), organisms were exposed to a single concentration of 100 ppm; the nominal concentration was 103.4 ppm. After 48 hours, no immobility was observed in the control or treatment group. Based on the results of this test, propamocarb is determined to be practically non-toxic to freshwater invertebrates.

In a 21-day static-renewal toxicity test measuring the chronic toxicity of propamocarb technical to *Daphnia magna* (MRID 45727801), organisms were exposed at nominal concentrations of 0 (negative control), 5.0, 10, 20, 40, 80 and 160 ppm; mean measured concentrations were <1.4 (control), 4.6, 9.3, 19, 36, 76, and 150 ppm, respectively. Survival ranged from 96 % to 100% in all treatment levels except for the highest concentration, where 68% survival was observed. Due to a statistically significant effect on survival, the highest treatment group was removed from statistical analysis on offspring production and growth. Additionally, the time to first brood release was delayed at the highest treatment interval. There were no statistically significant differences in offspring production, when the highest treatment level was excluded. No sublethal signs of toxicity were observed in daphnia from the lower treatment levels. The difference in total length was statistically significant compared to the control in the top two treatment levels; differences in dry weight were statistically significant compared to the control at the 19 ppm and 36 ppm treatment levels. The resulting NOAEC and LOAEC, based on reductions in dry weight were 9.3 ppm and 19 ppm respectively.

3.1.3 Estuarine/Marine Fish Toxicity

In a static acute toxicity study with *Cyprinodon variegatus* (MRID 41834603), organisms were exposed to a single concentration of 100 ppm; the nominal concentration was 96.8 ppm. After 96 hours, there was no mortality or abnormal behavior observed. Based on the results of this study, propamocarb HCl is considered to be practically non-toxic to estuarine/marine fish.

There are no data available to measure the chronic toxicity of propamocarb HCl to estuarine/marine fish. Although a chronic toxicity study in estuarine/marine fish was required in the registration review DCI (GDCI-119302-1292); the study was later waived (September 2014; D413347).

3.1.4 Estuarine/Marine Invertebrate Toxicity

There are two studies available to measure the acute toxicity of propamocarb HCl to estuarine/marine invertebrates. In a 96-hour static test, conducted using *Americamysis bahia*, organisms were exposed to nominal concentrations of 0 (negative control), 7.5, 15, 30, 60 and 120 ppm; mean measured concentrations were <0.25 (negative control), 7.7, 15, 29, 58, and 120 ppm respectively. After 96 hours, mortality was 0% in the lowest two treatment levels, and 100% in the top three treatment levels. The 96 hour LC_{50} was determined to be 50.5 ppm, which categorizes propamocarb as slightly toxic to estuarine/marine invertebrates on an acute basis. Based on mortality, the NOAEC and LOAEC values were 15 and 29 ppm. No sublethal effects were observed in the surviving mysids.

In a 96-hour study measuring the effects of propamocarb on shell deposition to the Eastern oyster (MRID 42083104) under flow-through conditions, organisms were exposed to nominal concentrations of 0 (water control), 1.0, 2.6, 6.4, 16, 40 and 100 ppm; mean measured concentrations were 1.1, 2.2, 6.6, 12, 38, and 104 ppm respectively. Following 96 hours of exposure, the control oysters had a mean new shell growth of 3.69 mm. Mean new shell growth ranged from 4.33 to 123% of the control new shell growth. The 96-hour EC_{50} was 39.2 ppm. ppm.

3.1.5 Aquatic Plant Toxicity

In a vascular aquatic plant study conducted with *Lemna gibba* (MRID 45894313), the test species was exposed to nominal concentrations of 0 (negative control), 133, 240, 426, 745 and 1330 ppm under static renewal conditions; mean measured concentrations of <0.28 (control), 85, 273, 844 for the control, 133, 426, and 1330 ppm treatment groups, respectively (the only concentrations measured during the study period). The test was conducted using ProPlant product; the actual concentrations were 120, 220, 390, 690 and 1230 ppm. The percent inhibition for mean live frond numbers were 0, 21, 34, 38 and 60% in the treatment groups, respectively. The percent inhibitions for wet weight were 2, 16, 32, 49 and 86% in the treatment groups, respectively, compares to the control. The percent inhibitions for growth rates were -0.4, 7.7, 14.3, 16.9, and 32.9% in the treatment groups, respectively, compared to the control. Biomass was the most sensitive endpoint, resulting in an EC_{50} of 476.1 ppm and a NOAEC of 269.1 ppm.

In a nonvascular plant study conducted using *Selenastrum capricornutum* (MRID 45894312), the cell density was the most sensitive endpoint; the EC_{50} was 170 ppm and the NOAEC was 71 ppm. However, all measured parameters showed inhibition $\geq$ 25% in the top 4 treatment groups (>130 ppm).

3.2 Terrestrial Organisms

Propamocarb exposure effects on terrestrial organisms were determined by assessing birds, mammals, invertebrates and terrestrial plants. The most endpoints, used in risk quantification, have been tabulated in **Table 18.** A brief summary of the individual studies can be found in the following sections.

Table 18. Summary of most sensitive endpoints for terrestrial organisms exposed to propamocarb

Test Species	Study Type	Endpoint (mg/kg bw) or mg/kg diet)	Acute Toxicity Classification/ Affected Endpoint (MRID)	Guideline Acceptability
Northern Bobwhite Quail *(Colinus virginianus*)	Acute oral toxicity	**14-d LD_{50} >2000 mg/kg-bw NOAEC = 225 mg/kg-bw**	Practically non-toxic (40342930)	850.2100; Supplemental/Quantitative
Mallard *(Platyrhynchos anas)*	Subacute dietary toxicity	**16-d LC_{50}=4160 mg/kg-diet**	Slightly toxic (46145210)	850.2200; Acceptable
Mallard *(Platyrhynchos anas)*	Chronic reproduction	**NOAEC=250 mg/kg-diet** LOAEC=990 mg/kg-diet	Adult female bodyweight (46145212)	850.2300; Acceptable
Norway rat	Acute Oral	LD_{50} >2,000 mg/kg bw	Practically non-toxic (44304907)	870.1100; Acceptable
Norway rat (*Rattus norvegicus*)	2-gen Reproduction	**NOAEL=1250 mg/kg-diet** LOAEL = 8000 mg/kg-diet	Decreased body weight (44730103; 44730102)	870.3800; Acceptable

Table 18. Summary of most sensitive endpoints for terrestrial organisms exposed to propamocarb				
Test Species	**Study Type**	**Endpoint (mg/kg bw) or mg/kg diet)**	**Acute Toxicity Classification/ Affected Endpoint (MRID)**	**Guideline Acceptability**
Multiple species	Seedling Emergence	Monocot EC_{25} > 8.0 lbs ai/A Dicot EC_{25} > 8.0 lbs ai/A	NA (45894310)	850.4100; Acceptable
Multiple species	Vegetative Vigor	Monocot EC_{25} > 8.0 lbs ai/A Dicot EC_{25} > 8.0 lbs ai/A	NA (45894311)	850.4150; Supplemental/Quantitative
Honey bee (*Apis mellifera*)	Honeybee acute contact	LD_{50} (contact): > 100 µg ai/bee	Practically non-toxic (44324501)	850.3030; 850.3020; Acceptable
N.A = not applicable [2]Based on mean measured concentrations				

3.2.1 Avian toxicity

In a 14 day acute oral toxicity test measuring the toxicity of propamocarb to juvenile bobwhite quail, the nominal concentrations were 0 (vehicle control), 112, 225, 500, 1000, and 2000 mg ai/kg. Mortality occurred in 30% of the birds at the highest treatment level after 7 hours of dozing. Treatment related signs of toxicity were observed in the top three treatment groups; clinical signs of toxicity included fluid feces, quick breathing, ptosis, hunched posture, abnormal posture of the head, uncoordinated movements, tremors, spasms, ventro-lateral recumbency, and slow breathing. Effects subsided from all surviving organisms by day 4. No treatment related effects on body weight were observed; a treatment-related effect on food consumption was observed in both sexes in the highest treatment group between days 1 and 4. The 14 day LD_{50} was determined to be >2000 mg /kg-bw, categorizing propamocarb as practically non-toxic on an acute oral basis. This study was classified as supplemental.

In a dietary study conducted using the mallard, the LC_{50} was determined to be >5000 ppm. The organisms were dosed at nominal concentrations of 163, 325, 650, 1300, 2600 and 5200 ppm. No mortalities were noted during the test duration; a reduction in body weight increase and feed consumption was observed in the highest concentration treatment group during the exposure period. The study indicates that propamocarb HCl is practically non-toxic to birds on a dietary basis. The study is classified as supplemental based on a lack of analytical data included in the summary report.

A one generation, reproductive toxicity test, conducted using propamocarb HCl on the mallard, was conducted over 23 weeks. The organisms were dosed at nominal concentrations of 0 (vehicle control), 250, 1000, and 4000 ppm diet; the mean measured concentrations were <19 (vehicle control), 250, 990, and 3800 ppm diet. There were no treatment related effects on adult mortality, food consumption, or terminal necropsy at any treatment level. Wetting and spilling of food was observed in all pens at the 3800 ppm diet and mean female body weight gain from the 990 and 3800 ppm treatment groups were statistically lower than corresponding controls; a similar effect was not observed in males. Treatment related effects were observed at the highest dose on eggs laid per pen, eggs set per pen, viable embryos per pen, live embryos per pen, number of hatchlings per pen, hatchlings per egg set, hatching survival per pen, and hatchling survival per eggs. Based on a treatment related effect on female weight gain, the NOAEC and LOAEC levels were 250 and 990 ppm-diet, respectively. The study is classified as supplemental because the homogeneity assessment revealed that the substance was not evenly mixed within the diet.

3.2.2 Terrestrial Invertebrate toxicity

In an acute contact study conducted using the honey bee, *Apis mellifera*, organisms were dosed at nominal concentrations of 6.25, 12.5, 25, 50, and 100 μg ai/bee. Up to the maximum concentration of 100 μg/bee, mortality did not exceed 2%. Thus, the LC_{50} exceeds the maximum dose tested. Propamocarb is classified as practically non-toxic to bees on an acute contact basis.

3.2.3 Terrestrial Plant Toxicity

Seedling emergence was studied on 10 plant species after pre-emergent application of propamocarb HCl. This was a limit test conducted with a single application equivalent to the rate that is used on turf. Test species included cucumber, corn, soybean, tomato, ryegrass, lettuce, carrot, onion, cabbage, and oat. There were significant reductions in dry weight (tomato, 24.3%, cabbage, 20.4%, and oat, 22.4%) and length (cucumber, 7.1%, and soybean 9.2%) in some species tested, however, none of these reductions exceeded 25%. As a result, the EC_{25} was >8.037 (8.0 lb /A) for all plant species.

The effect of propamocarb was studied on 10 plant species after post emergent application. Test species included cabbage, carrot, corn, cucumber, lettuce, oat, onion, ryegrass, soybean and tomato. There were statistically significant reductions in dry weight (soybean, 14%, corn, 8%) and length (oat, 8%, carrot, 6%) of some species, however none of these reductions exceeded 25%. As a result, the EC_{25} was >8.0 lb/A for all tested species. Necrosis was noted on the foliage of all dicot species tested.

3.3 Incident Data

The Incident Data System (IDS), which is maintained by the Agency's Office of Pesticide Programs, was searched to determine if ecological incidents have been reported for propamocarb. Based on a search of IDS conducted in October 2016 there were two reported wildlife incidents associated with propamocarb. Both reported incidents were associated with the use of Previcur Flex (EPA Registration No. **264-678)**.

The first incident (I013246-040) was reported on June 20, 2002; the incident took place in Fairview Montana. Use of Previcur Flex damaged 200 acres of a 500-acre crop of sugar beets. The damage symptom was “stunting.” Propamocarb was said to be the “probable cause;” however, no residue analysis was available to confirm the presence of propamocarb. The legality of the use is undetermined.

The second incident (I022217-035) was reported on July 7, 2010; the incident took place in Aroostook, Maine. Previcur Flex was applied to a field of potatoes, resulting in a 50% kill of a 200 acre potato field. The potato plants suffered marginal leaf burn and alleged phytotoxic reaction to the product following the application to the potato crop. Propamocarb was said to be the “possible cause;” the registrant also suggested that high temperatures may have been the cause. No residue analysis was available to confirm the presence of propamocarb. The legality of the use is undetermined.

Because of limitations in the incident reporting system, the lack of additional incident reports cannot be construed as the absence of incidents from the registered use of propamocarb.

4.0 Risk Characterization

As discussed in the problem formulation, risk characterization integrates EECs and toxicity estimates and evaluates the potential for of adverse ecological effects to non-target species. For propamocarb, a deterministic approach is used to evaluate the potential for of adverse ecological effects to non-target species. In this approach, RQs are calculated by dividing EECs by acute and chronic ecotoxicity values for non-target species.

Risk Quotient (RQ) = Exposure Estimate/Toxicity Estimate

The RQ value is a unitless number and for this reason, the magnitude of the RQ value cannot be used to quantitatively gauge the potential for or magnitude of an adverse effect resulting from exposure to propamocarb. Rather, the resulting RQ values are compared to LOCs (**Table 19**) which serve as thresholds above which exposure from the labeled use (or proposed use) of the pesticide is considered to have the potential to cause adverse effects for the non-target organisms/taxa for which the value is intended to represent. The LOCs currently address the following risk presumption categories:

Animals:

- **Acute risk—**potential for acute risk to non-target organisms which may warrant regulatory action in addition to restricted classification
- **Acute risk, listed species—**listed species may be potentially affected by use
- **Chronic risk—**potential for chronic risk may warrant regulatory action, listed species may potentially be affected through chronic exposure

Plants:

- **Non-listed plant risk—**potential for effects in non-target (non-endangered) plants
- **Listed plant risk—**potential for effects in endangered plants

<table>
<tr><th colspan="4">Table 19. Agency Risk Quotient (RQ) Metrics and Levels of Concern (LOC) Per Risk Class.</th></tr>
<tr><th>Risk Class</th><th>Risk Description</th><th>RQ</th><th>LOC</th></tr>
<tr><th colspan="4">Aquatic Animals (fish and invertebrates)</th></tr>
<tr><td>Acute Risk to non-listed Species</td><td>Potential for effects to non-listed animals from acute exposures</td><td>Peak EEC/LC_{50}[1]</td><td>0.5</td></tr>
<tr><td>Acute Risk to Listed Species</td><td>Listed species may be potentially affected by acute exposures</td><td>Peak EEC/LC_{50}[1]</td><td>0.05</td></tr>
<tr><td rowspan="2">Chronic</td><td rowspan="2">Potential for effects to non-listed and listed animals from chronic exposures</td><td>60-day EEC/NOAEC (fish)</td><td rowspan="2">1</td></tr>
<tr><td>21-day EEC/NOAEC (invertebrates)</td></tr>
<tr><th colspan="4">Aquatic Plants</th></tr>
<tr><td>Non-Listed</td><td>Potential for effects to non-listed plants from exposures</td><td>Peak EEC/LC_{50}[1]</td><td>1</td></tr>
<tr><td>Listed</td><td>Potential for effects to listed plants from exposures</td><td>Peak EEC/NOAEC</td><td>1</td></tr>
<tr><th colspan="4">Terrestrial Animals (mammals and birds)[2]</th></tr>
<tr><td rowspan="2">Acute Risk to non-listed Species</td><td rowspan="2">Potential for effects to non-listed animals from acute exposures</td><td>EEC/LC_{50} (Dietary)</td><td rowspan="2">0.5</td></tr>
<tr><td>EEC/LD_{50} (Dose)</td></tr>
<tr><td rowspan="2">Acute Risk to Listed Species</td><td rowspan="2">Listed species may be potentially affected by acute exposures</td><td>EEC/LC_{50} (Dietary)</td><td rowspan="2">0.1</td></tr>
<tr><td>EEC/LD_{50} (Dose)</td></tr>
<tr><td>Chronic Risk</td><td>Potential for effects to non-listed and listed animals from chronic exposures</td><td>EEC/NOAEC</td><td>1</td></tr>
<tr><th colspan="4">Terrestrial and Semi-Aquatic Plants</th></tr>
<tr><td>Non-Listed</td><td>Potential for effects to non-target, non-listed plants from exposures</td><td>EEC/ EC_{25}</td><td>1</td></tr>
<tr><td rowspan="2">Listed Plant</td><td rowspan="2">Potential for effects to non-target, listed plants from exposures</td><td>EEC/ NOAEC</td><td rowspan="2">1</td></tr>
<tr><td>EEC/ EC_{05}</td></tr>
</table>

This assessment of the labeled uses of propamocarb relies on the deterministic RQ method to provide a metric of potential risks. The RQ provides a comparison of exposure estimates to toxicity endpoints (*i.e.*, the estimated exposure concentrations are divided by acute and chronic toxicity values, respectively). The resulting unitless RQ values are compared to the Agency's LOCs, as shown in **Table 20** through **Table 24. RQ Values for direct effects to aquatic vascular and nonvascular plants resulting from exposure to propamocarb[1]** The LOCs are used by the Agency to indicate when the use of a pesticide, as directed by the label, has the potential to cause adverse effects to non-target organisms. In this assessment, RQs that exceed the non-listed species LOC also exceed the listed species LOC.

Note that with plants, unlike with animals, RQ values are not presented for acute versus chronic risk; instead, RQ values are presented for listed and non-listed species based on a comparison of a given EEC to NOAEL and EC_{25}/EC_{50} values, respectively. A discussion of the RQ values for propamocarb and of other information that provides context for the interpretation of potential risk to various taxa is presented in the Risk Description in **Section 4.3**.

4.1 Risk Estimation for Aquatic Organisms

4.1.1 Freshwater Fish

Acute risk to freshwater fish and aquatic-phase amphibians is based on 1 in 10 year peak EECs in the standard pond and the lowest acute toxicity value for freshwater fish. Chronic risk is based on the 1 in 10 year 60-day EECs and the lowest chronic toxicity value for freshwater fish. Acute and chronic risk quotients for freshwater fish are shown in **Table 20**.

The scenario resulting in the highest peak exposure values was indicated for ornamental foliar applications. As the most sensitive acute freshwater fish endpoint (EC_{50} >99000 µg ai/L) is multiple orders of magnitude higher than the highest peak EECs (2,150 µg ai/L) for each of the modeled scenarios, all results were well below the acute LOCs. The toxicity endpoint used in risk estimation for acute risk is a greater than, non-definitive value; the results are considered to be a upper bound estimate, and the RQ is estimated to be less than values presented. Similarly, the chronic freshwater fish toxicity endpoint (NOAEC = 6300 µg ai/L) is significantly higher than the highest 60-day average EEC (708 µg ai/L) and therefore all chronic RQs were below the chronic LOC of 1.0; the maximum chronic RQ was 0.112.

Based on the results of this risk estimation, risk is not expected to freshwater fish on an acute or chronic basis.

Table 20. Acute and Chronic RQs for direct effects to freshwater fish resulting from exposure to propamocarb[1]

Use(s)	Scenario	Peak EECs (µg a.i./L)	Freshwater Fish EC_{50} >99000 µg a.i/L Acute RQ	60-day EECs (µg a.i./L)	Freshwater Fish NOAEC = 6300 µg a.i/L Chronic RQ
Lima Beans	MIbeansSTD+42	59	<0.01	33	<0.01
Cucurbits	STXmelonNMC+56	79	<0.01	27	<0.01
Fruiting vegetables	FLpeppersSTD+28	90	<0.01	36	<0.01
Lettuce	CAlettuceSTD+14	51	<0.01	32	<0.01
Ornamental Foliar	FLnurserySTD_V2+80	2,150	<0.02	708	<0.1
Ornamental Drench	FLnurserySTD_V2+80	1,610	<0.02	515	<0.08

Table 20. Acute and Chronic RQs for direct effects to freshwater fish resulting from exposure to propamocarb[1]					
Use(s)	**Scenario**	**Peak EECs (µg a.i./L)**	**Freshwater Fish** EC_{50} >99000 µg a.i/L	**60-day EECs (µg a.i./L)**	**Freshwater Fish** NOAEC = 6300 µg a.i/L
			Acute RQ		**Chronic RQ**
Potatoes	FLpotatoNMC+0	43	<0.01	26	<0.01
Turf	PAturfSTF+112	97	<0.01	43	<0.01
Conifer	CAForestryRLF+70	26	<0.01	18	<0.01

App. = Application
[1]Acute listed species LOC = 0.05; acute non-listed LOC = 0.5; chronic risk LOC = 1

4.1.2 Freshwater Invertebrates

Acute risk to freshwater invertebrates is based on 1 in 10 year peak EECs in the standard pong and the lowest acute toxicity value for freshwater invertebrates. Chronic risk is based on the 1 in 10 year 21-day EEC and the lowest chronic toxicity value for freshwater invertebrates. Acute and chronic risk quotients for freshwater invertebrates are shown in **Table 21.**

Acute risk to freshwater invertebrates is based on 1 in 10 year peak EECs and the lowest acute toxicity value for freshwater invertebrates. Similar to that of the freshwater fish presented above, the most sensitive acute freshwater invertebrate toxicity endpoint (EC_{50} > 103,400 µg ai/L) is multiple orders of magnitude higher than the peak EECs (2,150 µg ai/L) for each of the modeled scenarios. Therefore all result were below the acute LOCs. The toxicity endpoint used in risk estimation for acute risk is a greater than, non-definitive value; the results are considered to be an upper bound estimate, and the RQ is estimated to be less than values presented. The chronic freshwater invertebrate toxicity endpoint for freshwater invertebrates (NOAEC = 9,300 µg ai/L) is significantly higher than the highest 21-day average EEC (1,300 µg ai/L) Therefore all chronic RQs were below the chronic LOC of 1.0; the maximum chronic RQ was 0.140.

Based on the results of this risk estimation, risk to freshwater invertebrates is not on an acute or chronic basis.

Table 21. Acute and chronic RQs for direct effects to freshwater invertebrates resulting from exposure to propamocarb[1]					
Use(s)	**Scenario**	**Peak EECs (µg a.i./L)**	**Freshwater Invertebrates** EC_{50} = >103400 µg a.i/L	**21-day EECs (µg a.i./L)**	**Freshwater Invertebrates** NOAEC = 9300 µg a.i/L
			Acute RQ		**Chronic RQ**
Lima Beans	MIbeansSTD+42	59	<0.01	44	<0.01

Table 21. Acute and chronic RQs for direct effects to freshwater invertebrates resulting from exposure to propamocarb[1]

Use(s)	Scenario	Peak EECs (µg a.i./L)	Freshwater Invertebrates EC_{50} = >103400 µg a.i/L	21-day EECs (µg a.i./L)	Freshwater Invertebrates NOAEC = 9300 µg a.i/L
			Acute RQ		**Chronic RQ**
Cucurbits	STXmelonNMC+56	79	<0.01	47	<0.01
Fruiting vegetables	FLpeppersSTD+28	90	<0.01	59	<0.01
Lettuce	CAlettuceSTD+14	51	<0.01	39	<0.01
Ornamental Foliar	FLnurserySTD_V2+80	2150	<0.02	1300	<0.14
Ornamental Drench	FLnurserySTD_V2+80	1610	<0.02	977	<0.11
Potatoes	FLpotatoNMC+0	43	<0.01	34	<0.01
Turf	PAturfSTF+112	97	<0.01	68	<0.01
Conifer	CAForestryRLF+70	26	<0.01	21	<0.01

[App.] = Application

[1]Acute listed species LOC = 0.05;chronic risk LOC = 1

4.1.3 Estuarine/marine Fish

Acute risk to estuarine/marine fish is based on 1 in 10 year peak EECs in the standard pond and the lowest acute toxicity value for estuarine/marine fish. Chronic data for estuarine/marine fish were not submitted and thus risk will not be estimated.

Acute risk to estuarine/marine fish is estimated in a similar manner as for freshwater fish; the same peak EECs are employed and compared to the most sensitive toxicity endpoints for estuarine/marine species.

As was the case for acute toxicity to freshwater fish, the most sensitive acute toxicity endpoint for estuarine/marine fish (EC_{50} = 49,000 µg/L) was multiple orders of magnitude above the highest peak EEC values (2,150 µg ai/L) from all uses modeled and therefor all acute RQs were below all acute LOCs.

Based on the results of this risk estimation, risk is not expected for estuarine/marine species on an acute basis. While chronic toxicity values are not available for propamocarb, chronic toxicity testing would have to show one order of magnitude increased toxicity to trigger concern for ornamental uses and three orders of magnitude for agricultural uses.

Table 22. Acute RQs for direct effects to estuarine/marine fish resulting from exposure to propamocarb[1]			
Use(s)	**Scenario**	**Peak EECs (µg a.i./L)**	**Estuarine/marine Fish** EC_{50} = 49000 µg a.i/L
			Acute RQ
Lima Beans	MIbeansSTD+42	59	<0.01
Cucurbits	STXmelonNMC+56	79	<0.01
Fruiting vegetables	FLpeppersSTD+28	90	<0.01
Lettuce	CAlettuceSTD+14	51	<0.01
Ornamental Foliar	FLnurserySTD_V2+80	2150	0.02
Ornamental Drench	FLnurserySTD_V2+80	1610	0.02
Potatoes	FLpotatoNMC+0	43	<0.01
Turf	PAturfSTF+112	97	<0.01
Conifer	CAForestryRLF+70	26	<0.01
[1]Acute listed species LOC = 0.05;chronic risk LOC =			

4.1.4 Estuarine/marine Invertebrates

Acute risk to estuarine/marine invertebrates is based on 1 in 10 year peak EECs in the standard pond and the lowest acute toxicity value for estuarine/marine invertebrates. Chronic data for estuarine/marine fish were not submitted and thus risk will not be estimated.

Acute risk to estuarine/marine invertebrates is estimates in a similar manner to that of freshwater invertebrates in that the same peak EECs are employed but compared to the most sensitive acute estuarine/marine toxicity endpoints. Acute risk quotients for estuarine/marine invertebrates are shown in **Table 23.**

Similar to freshwater invertebrates, the most sensitive acute estuarine/marine invertebrate toxicity value (EC_{50} = 5000 µg ai/L) was higher than the highest peak EEC (2,150 µg ai/L). Therefore, the resultant RQs were below all acute LOCs; the maximum RQ was 0.055.

Based on the results of this risk estimation, risk is not expected for estuarine/marine invertebrates. While no toxicity data is available for estuarine/marine invertebrates on a chronic basis, chronic mysid data would have to show increased sensitivity by 2 orders of magnitude to trigger concern.

Table 23. Acute RQs for direct effects to estuarine/marine invertebrates resulting from exposure to propamocarb[1]			
Use(s)	Scenario	Peak EECs (µg ai/L)	Estuarine/marine Invertebrates EC_{50} = 5000 µg a.i/L
			Acute RQ
Lima Beans	MIbeansSTD+42	59	<0.01
Cucurbits	STXmelonNMC+56	79	<0.01
Fruiting vegetables	FLpeppersSTD+28	90	<0.01
Lettuce	CAlettuceSTD+14	51	<0.01
Ornamental Foliar	FLnurserySTD_V2+80	2150	0.06
Ornamental Drench	FLnurserySTD_V2+80	1610	0.04
Potatoes	FLpotatoNMC+0	43	<0.01
Turf	PAturfSTF+112	97	<0.01
Conifer	CAForestryRLF+70	26	<0.01
[1]Acute listed species LOC = 0.05; chronic risk LOC = 1			

4.1.5 Aquatic Plants

Risk to aquatic non-vascular plants is based on 1 in 10 year peak EECs in the standard pond and the lowest EC_{50} value and NOAEC value. Listed species RQs are derived from a comparison of the peak EEC to the most sensitive NOAEC and non-listed RQs are derived from a comparison of the peak EEC to the most sensitive EC_{50} value available. Based on the modeled EECs and most sensitive toxicity endpoints for aquatic plants species, there were no RQ exceedances for listed or non-listed aquatic vascular or nonvascular plant species. The results have been tabulated in **Table 24**.

Table 24. RQ Values for direct effects to aquatic vascular and nonvascular plants resulting from exposure to propamocarb[1]						
Use(s)	Scenario	Peak EECs (µg a.i./L)	Aquatic Nonvascular Plants[2]		Aquatic Vascular Plants[2]	
			Listed RQs	Non-listed RQs	Listed RQs	Non-listed RQs
Lima Beans	MIbeansSTD+42	59	<0.01	<0.01	<0.01	<0.01
Cucurbits	STXmelonNMC+56	79	<0.01	<0.01	<0.01	<0.01
Fruiting vegetables	FLpeppersSTD+28	90	<0.01	<0.01	<0.01	<0.01
Lettuce	CAlettuceSTD+14	51	<0.01	<0.01	<0.01	<0.01
Ornamental Foliar	FLnurserySTD_V2+80	2150	0.01	0.03	<0.01	0.01
Ornamental Drench	FLnurserySTD_V2+80	1610	0.01	0.02	<0.01	0.01
Potatoes	FLpotatoNMC+0	43	<0.01	<0.01	<0.01	<0.01

Table 24. RQ Values for direct effects to aquatic vascular and nonvascular plants resulting from exposure to propamocarb[1]						
Use(s)	Scenario	Peak EECs (µg a.i./L)	Aquatic Nonvascular Plants[2]		Aquatic Vascular Plants[2]	
			Listed RQs	Non-listed RQs	Listed RQs	Non-listed RQs
Turf	PAturfSTF+112	97	<0.01	<0.01	<0.01	<0.01
Conifer	CAForestryRLF+70	26	<0.01	<0.01	<0.01	<0.01
[1]Listed aquatic plant LOC = 1; Non-listed aquatic plant LOC = 0.5 [2] For aquatic nonvascular plants, EC_{50} = 170000 µg a.i/L and NOAEC = 71000 µg a.i/L.						

4.2 Risk Estimation for Terrestrial Organisms

4.2.1 Risk to Birds

As previously discussed in **Section 2.5.1** potential direct effects to terrestrial species are based on ground and aerial spray uses of propamocarb. Potential risks to birds and, terrestrial-phase amphibians and reptiles are evaluated using T-REX, acute and chronic toxicity data for the most sensitive bird species for which data are available, and the most sensitive dietary item and size class for that species.

The acute and chronic dose-based and dietary-based RQs for birds are tabulated below in **Table 25, Table 26,** and **Table 27,** respectively.

Acute dose based risk to birds

Acute effects are estimated using the lowest available LD_{50} from an acute study for birds, terrestrial-phase amphibians, and reptiles. Dose-based EECs are divided by toxicity values to estimate acute dose -based RQs. The toxicity endpoint used in risk estimation for acute risk is a greater than, non-definitive value; the results are considered to be a upper bound estimate, and the RQ is estimated to be less than values presented. The bounding estimates for acute-dose based risk have been presented in **Table 25.** Acute dose-based RQ values for birds exposed to propamocarb (T-REX v. 1.5.2).[1,2]. LOC exceedances trend toward the highest application rates and toward smaller birds consuming short grass. With the ornamental usage rate significantly higher than all other application rates, there are exceedances for listed and non-listed species across all body sizes and feeding strategies, with the exception of granivores. The bounding estimates associated with this application range from 0.04 to 22.82; 14 of 20 upper bound estimates are above the non-listed species LOC.

For agricultural uses, the highest application rate is associated with use on lettuce; the highest upper bound estimate for lettuce was 0.94 for a small bird consuming short grass. There were additionally a number of acute listed species LOC exceedances associated with this use.

Based on the results of this risk estimation, risk cannot be precluded for birds exposed to propamocarb.

Table 25. Acute dose-based RQ values for birds exposed to propamocarb (T-REX v. 1.5.2).[1,2]

Primary Feeding Strategy →	**Herbivores and Omnivores**												**Insectivores**			**Granivores**		
Animal Size →	Sm				Med				Lg				Sm	Med	Lg	Sm	Med	Lg
Dietary Items → / **Use(s) ↓**	**Short Grass**	**Tall Grass**	**Broad-leaf Plants**	**Fruits, pods, seeds, *etc.***	**Short Grass**	**Tall Grass**	**Broadleaf Plants**	**Fruits, pods, seeds, *etc.***	**Short Grass**	**Tall Grass**	**Broadleaf Plants**	**Fruits, pods, seeds, *etc.***	**Arthropods**			**Seeds, grains, *etc.***		
Turf	**<4.09**	**<1.87**	**<2.30**	<0.26*	**<1.83**	**<0.84**	**<1.03**	<0.11*	**<0.58**	<0.27*	<0.33*	<0.04	**<1.60**	**<0.72**	<0.23*	<0.06	<0.03	<0.01
Ornamentals	**<22.8**	**<10.4**	**<12.8**	**<1.43**	**<10.2**	**<4.68**	**<5.75**	**<0.64**	**<3.24**	**<1.48**	**<1.82**	<0.20*	**<8.94**	**<4.00**	**<1.27**	<0.32	<0.14	<0.04
Cucurbits	**<0.66**	<0.30*	<0.37*	<0.04	<0.30*	<0.14*	<0.17*	<0.02	<0.09	<0.04	<0.05	<0.01	<0.26*	<0.12*	<0.04	<0.01	<0.01	<0.01
Fruiting Vegetables	**<0.56**	<0.26*	<0.32*	<0.04	<0.25*	<0.12*	<0.14*	<0.02	<0.08	<0.04	<0.04	<0.01	<0.22*	<0.10*	<0.03	<0.01	<0.01	<0.01
Tomatoes	**<0.83**	<0.38*	<0.47*	<0.05	<0.37*	<0.17*	<0.21*	<0.02	<0.12*	<0.05	<0.07	<0.01	<0.32*	<0.15*	<0.05	<0.01	<0.01	<0.01
Lettuce	**<0.94**	<0.43*	**<0.53**	<0.06	<0.42*	<0.19*	<0.24*	<0.03	<0.13*	<0.06	<0.07	<0.01	<0.37*	<0.16*	<0.05	<0.01	<0.01	<0.01
Conifer	**<0.96**	<0.44*	**<0.54**	<0.06	<0.43*	<0.20*	<0.24*	<0.03	<0.14*	<0.06	<0.08	<0.01	<0.38*	<0.17*	<0.05	<0.01	<0.01	<0.01

Bolded cells indicate an exceedance to listed birds.
[1]Using adjusted LD_{50} values of 1441, 1834, and 2581 mg a.i/kg-bw for small, medium, and large birds, respectively.
[2]Acute endangered species LOC = 0.1; acute high risk LOC = 0.5

Acute Dietary Based Risk to Birds

Dietary effects are estimated using the LC_{50} from a subacute feeding study for birds, terrestrial-phase amphibians and reptiles. Dietary based EECs are divided by toxicity values to estimate acute-dietary based RQs; these RQs have been tabulated in Table XX. The two highest application rates, associated with uses on turf and ornamentals have a number of exceedances for listed and non listed species. RQs for all other uses range from 0.01 to 0.29 with some exceeding the LOC for listed species.

Based on the results of this risk estimation, risk cannot be precluded for birds exposed to propamocarb.

Table 26. Acute dietary-based RQs for birds, reptiles, and terrestrial-phase amphibians of different feeding classes (T-REX v. 1.5.2).[1]

Primary Feeding Strategy →	Herbivores, Omnivores, and Granivores				Insectivores
Dietary Items → / Use(s) ↓	Short Grass	Tall Grass	Broad-leaf Plants	Fruits, pods, seeds, *etc*.	Arthropods
Turf	**1.24**	**0.57**	**0.70**	0.08	0.49*
Ornamentals	**6.94**	**3.18**	**3.90**	0.43*	**2.72**
Cucurbits	0.20*	0.09	0.11*	0.01	0.08
Fruiting Vegetables	0.17*	0.08	0.10*	0.01	0.07
Tomatoes	0.25*	0.12*	0.14*	0.02	0.10*
Lettuce	0.28*	0.13*	0.16*	0.02	0.11*
Conifer	0.29*	0.13*	0.16*	0.02	0.11*

[1]Acute endangered species LOC = 0.1; acute high risk LOC = 0.5
Based on adjusted LC_{50} of 4160 mg kg-bw

Chronic dietary based risk to birds

Chronic effects are estimated using the lowest available NOAEC from a chronic study for birds, terrestrial-phase amphibians, and reptiles. Dietary-based EECs are divided by toxicity values to estimate chronic dietary-based RQs. Chronic dietary-based RQs are tabulated in **Table 27.** There were RQs that exceeded the LOC across all uses and most feeding strategies. The only feed strategy that had some RQs below the LOC were for organisms consuming fruits, pods, seeds etc. For a small bird consuming short grass, the chronic RQs ranged from 2.84 for fruiting vegetables (the lowest application rate) to 115.47 for ornamentals (the highest application rate).

Based on the results of this risk estimation, risk cannot be precluded for birds exposed to propamocarb.

Table 27. Chronic dietary-based RQs for birds, reptiles, and terrestrial-phase amphibians of different feeding classes (T-REX v. 1.5.2).[1]					
Primary Feeding Strategy →	**Herbivores, Omnivores, and Granivores**				**Insectivores**
Dietary Items → / **Use(s) ↓**	**Short Grass**	**Tall Grass**	**Broad-leaf Plants**	**Fruits, pods, seeds, *etc*.**	**Arthropods**
Turf	**20.69**	**9.48**	**11.64**	**1.29**	**8.10**
Ornamentals	**115.47**	**52.92**	**64.95**	**7.22**	**45.22**
Cucurbits	**3.34**	**1.53**	**1.88**	0.21	**1.31**
Fruiting Vegetables	**2.84**	**1.30**	**1.60**	0.18	**1.11**
Tomatoes	**4.19**	**1.92**	**2.36**	0.26	**1.64**
Lettuce	**4.73**	**2.17**	**2.66**	0.30	**1.85**
Conifer	**4.85**	**2.22**	**2.73**	0.30	**1.90**
[1]Chronic LOC for listed and non-listed species = 1.0 Based on adjusted NOAEC of 250 ppm					

4.2.2 Risk to Mammals

Potential risks to mammals are evaluated using T-REX, acute and chronic toxicity data for laboratory rats, and the most sensitive dietary item and size class for that species. For mammals the most sensitive RQ in T-REX is for the small mammal consuming short grass. The specific EECs for each species are for the same size mammals and same dietary items as those considered for acute exposure.

The acute and chronic dose-based and dietary-based RQs for mammals are tabulated below in **Table 29, Table 30,** and **Table 30** respectively.

Acute dose based risk to mammals

Acute effects are estimated using the lowest available LD_{50} from an acute study for mammals. Dose-based EECs are divided by toxicity values to estimate acute dose -based RQs. The toxicity endpoint used in risk estimation for acute risk is a greater than, non-definitive value; the results are considered to be a upper bound estimate, and the RQ is estimated to be less than values presented. The bounding estimates for acute-dose based risk have been presented in **Table 28**.

Acute dose based bounding estimates for mammals exceeded the acute LOC for listed and non-listed species for a number of feeding strategies for uses on ornamentals and turf. The remainder of the uses has some upper bound estimates that exceeded the listed species LOC.

Based on the results of this risk estimation, risk cannot be precluded for mammals.

Table 28. Acute dose-based RQ values for mammals exposed to propamocarb (T-REX v. 1.5.2)[1,2,]																		
Primary Feeding Strategy →	**Herbivores and Omnivores**												**Insectivores**			**Granivores**		
Animal Size →	Sm				Med				Lg				Sm	Med	Lg	Sm	Med	Lg
Dietary Items → / **Use(s) ↓**	**Short Grass**	**Tall Grass**	**Broad-leaf Plants**	**Fruits, pods, seeds, *etc.***	**Short Grass**	**Tall Grass**	**Broadleaf Plants**	**Fruits, pods, seeds, *etc.***	**Short Grass**	**Tall Grass**	**Broadleaf Plants**	**Fruits, pods, seeds, *etc.***	**Arthropods**			**Seeds, grains, *etc.***		
Food crops																		
Turf	**<1.12**	**<0.51**	<0.63*	<0.07	**<0.96**	<0.44*	**<0.54**	<0.06	**<0.51**	<0.24*	<0.29*	<0.03	<0.44*	<0.38*	<0.20*	<0.02	<0.01	<0.01
Ornamentals	**<6.26**	**<2.87**	**<3.52**	<0.39*	**<5.35**	**<2.45**	**<3.01**	<0.33*	**<2.87**	**<1.31**	**<1.61**	<0.18*	**<2.45**	**<2.09**	**<1.12**	<0.09	<0.07	<0.04
Cucurbits	<0.18*	<0.08	<0.10*	<0.01	<0.15*	<0.07	<0.09	<0.01	<0.08	<0.04	<0.05	<0.01	<0.07	<0.06	<0.03	<0.01	<0.01	<0.01
Fruiting Vegetables	<0.15*	<0.07	<0.09	<0.01	<0.13*	<0.06	<0.07	<0.01	<0.07	<0.03	<0.04	<0.01	<0.06	<0.05	<0.03	<0.01	<0.01	<0.01
Tomatoes	<0.23*	<0.10*	<0.13*	<0.01	<0.19*	<0.09	<0.11*	<0.01	<0.10*	<0.05	<0.06	<0.01	<0.09	<0.08	<0.04	<0.01	<0.01	<0.01
Lettuce	<0.26*	<0.12*	<0.14*	<0.02	<0.22*	<0.10*	<0.12*	<0.01	<0.12*	<0.05	<0.07	<0.01	<0.10*	<0.09	<0.05	<0.01	<0.01	<0.01
Conifer	<0.26*	<0.12*	<0.15*	<0.02	<0.22*	<0.10*	<0.13*	<0.01	<0.12*	<0.06	<0.07	<0.01	<0.10*	<0.09	<0.05	<0.01	<0.01	<0.01

Bolded and shaded cells indicate that the RQ exceeds an LOC for acute risk to listed mammals
[1]Using adjusted LD_{50} values of 4396, 3557, and 1538 for small, medium, and large mammals, respectively.
[2]Acute endangered species LOC = 0.1

Chronic dose based risk to mammals

Chronic effects are estimated using the lowest available NOAEC from a chronic study for mammals. Dose-based EECs are divided by toxicity values to estimate chronic dose -based RQs. The chronic RQs have been presented in **Table 29.** There are numerous RQs that result in chronic exceedances for propamocarb.

For use on ornamentals, RQs across all mammal sizes and feeding strategies result in RQs above the chronic LOC of 1.0. The RQs for this use alone range from 1.27 to 200.36. The uses that have the lowest application rates still have numerous RQs that exceed the chronic LOC; fruiting vegetables (the use with the lowest application rate) has a maximum of RQ of 4.93; these LOC exceedances stretch through all body sizes and nearly all feeding strategies (excluding fruits, pods seeds etc. and seeds and grains).

Based on the results of this risk estimation, risk cannot be precluded for mammals.

Table 29. Chronic dose-based RQ values for mammals exposed to propamocarb (T-REX v.1.5.2).[1,2]

Primary Feeding Strategy →	**Herbivores and Omnivores**												**Insectivores**			**Granivores**		
Animal Size →	Sm				Med				Lg				Sm	Med	Lg	Sm	Med	Lg
Dietary Items → / **Use(s) ↓**	**Short Grass**	**Tall Grass**	**Broad-leaf Plants**	**Fruits, pods, seeds, *etc.***	**Short Grass**	**Tall Grass**	**Broadleaf Plants**	**Fruits, pods, seeds, *etc.***	**Short Grass**	**Tall Grass**	**Broadleaf Plants**	**Fruits, pods, seeds, *etc.***	**Arthropods**			**Seeds, grains, *etc.***		
Turf	**35.90**	**16.4**	**20.2**	**2.24**	**30.67**	**14.06**	**17.25**	**1.92**	**16.44**	**7.53**	**9.25**	**1.03**	**14.06**	**12.01**	**6.44**	0.50	0.43	0.23
Ornamentals	**200.36**	**91.83**	**112.70**	**12.52**	**171.14**	**78.44**	**96.27**	**10.70**	**91.74**	**42.05**	**51.60**	**5.73**	**78.47**	**67.03**	**35.93**	**2.78**	**2.38**	**1.27**
Cucurbits	**5.79**	**2.65**	**3.26**	0.36	**4.95**	**2.27**	**2.78**	0.31	**2.65**	**1.22**	**1.49**	0.17	**2.27**	**1.94**	**1.04**	0.08	0.07	0.04
Fruiting Vegetables	**4.93**	**2.26**	**2.77**	0.31	**4.21**	**1.93**	**2.37**	0.26	**2.26**	**1.03**	**1.27**	0.14	**1.93**	**1.65**	**0.88**	0.07	0.06	0.03
Tomatoes	**7.27**	**3.33**	**4.09**	0.45	**6.21**	**2.85**	**3.49**	0.39	**3.33**	**1.53**	**1.87**	0.21	**2.85**	**2.43**	**1.30**	0.10	0.09	0.05
Lettuce	**8.22**	**2.77**	**4.62**	0.51	**7.02**	**3.22**	**3.95**	0.44	**3.76**	**1.72**	**2.12**	0.24	**3.22**	**2.75**	**1.47**	0.11	0.10	0.05
Conifer	**8.41**	**3.86**	**4.73**	0.53	**7.19**	**3.29**	**4.04**	0.45	**3.85**	**1.77**	**2.17**	0.24	**3.30**	**2.81**	**1.1**	0.12	0.10	0.05

Bolded and shaded cells indicate that the RQ exceeds an LOC for chronic risk to listed and non-listed mammals.
[1]Using adjusted NOAEL values of 137, 111, and 185 mg a.i/kg-diet for small, medium, and large mammals, respectively.
[2]Chronic risk LOC = 1.0

Chronic dietary based risk to mammals

Dietary-based EECs are divided by toxicity values to estimate chronic dietary-based RQs. Chronic dietary based RQs have been presented in **Table 30.**

RQ exceedances are confined to the uses associated with the highest application rates: ornamentals and turf. The RQs for ornamentals range from 1.44 to 23.09.

Based on the results of this risk estimation, risk cannot be precluded for mammals.

Table 30. Chronic dietary-based RQs for mammals of exposed to propamocarb (T-REX v.1.5.2). [1]

Primary Feeding Strategy →	**Herbivores, Omnivores, and Granivores**				**Insectivores**
Dietary Items → / **Use(s) ↓**	**Short Grass**	**Tall Grass**	**Broad-leaf Plants**	**Fruits, pods, seeds, *etc*.**	**Arthropods**
Food crops					
Turf	**4.14**	**1.90**	**2.33**	0.26	**1.62**
Ornamentals	**23.09**	**10.58**	**12.99**	**1.44**	**9.04**
Cucurbits	0.67	0.31	0.38	0.04	0.26
Fruiting Vegetables	0.57	0.26	0.32	0.04	0.22
Tomatoes	0.84	0.38	0.47	0.05	0.33
Lettuce	0.95	0.43	0.53	0.06	0.37
Conifer	0.97	0.44	0.55	0.06	0.38

Bolded values indicate LOC exceedance
[1]Chronic risk LOC = 1
Based on an adjusted NOAEC of 1250 ppm

4.2.3 Risk to honeybees

Table 31 summarizes the acute contact RQ values for adult honey bees that are assumed to be foraging on the treated crop during pesticide application. As such, Table 31 includes only those crops that are considered bee attractive or for which no data are available on bee attractiveness.

For these crops and proposed application rates, acute contact RQ values are below the LOC of 0.4 for all uses except for ornamentals. The estimate of contact exposure is considered conservative (although not impossible) since it is determined using a high end estimate of forager bees exposure to spray droplets.

Data are only available for the acute oral toxicity of propamocarb to bees; the acute oral toxicity of propamocarb to bees remains an uncertainty.

Table 31. Tier 1 Adult, Acute Contact Risk Quotients for Honey Bees Foraging on Treated Fields				
Crop/ Max. Single Application Rate	**Bee Attractiveness**	**Dose (*μ*g a.i./bee per 1 lb a.i./A)[1]**	**Propamocarb Contact LD_{50} (μg a.i./bee)**	**Acute RQ)[2][3]**
Ornamentals; 64.3 lb ai/A	Unknown	174	>100	1.74
Turf; 8.2 lb ai/A	Unknown	22.1	>100	0.22
Cucurbits; 0.90 lb ai/A	Pollen (Yes) Nectar (Yes)	2.43	>100	0.24
Fruiting Vegetables; 0.90 lb ai/A	Pollen (Yes) Nectar (Yes)	2.43	>100	0.24
Peppers; 0.90 lb ai/A	Pollen (Yes) Nectar (No)	2.43	>100	0.24
Tomatoes; 1.13 lb ai/A	Pollen (No) Nectar (No)	3.05	>100	0.03
Lettuce; 1.50 lb ai/A	Pollen (Yes) Nectar (Yes)	4.05	>100	0.04
Lima beans; 1.50 lb ai/A	Pollen (Yes) Nectar (Yes)	4.05	>100	0.04
Potatoes; 0.90 lb ai/A	Pollen (No) Nectar (No)	2.43	>100	0.24
Conifer; 2.70 lb ai/A	Unknown	7.29	>100	0.07

(1) Source: USEPA 2014. Guidance for Assessing Pesticide Risks to Bees.
(2) Based on a 48-h acute contact LD_{50} of >100 ug ai/bee for propamocarb (MRID 43868324).
(3) Terrestrial invertebrate LOC is 0.4. RQ values provided for crops with unknown bee attractiveness are assumed to be attractive to bees.

4.2.4 Risk to terrestrial plants

Risk to terrestrial plants in dry and semi-aquatic areas resulting from runoff and spray drift of propamocarb were estimated using the TerrPlant (v.1.2.2) model. The TerrPlant derived EECs are compared to the most sensitive monocot and dicot EC_{25} to generate a non-listed species RQ and compared to the most sensitive NOAEC or EC_{05} to generate a listed species RQ. The listed and non-listed terrestrial plant LOC is 1.

For vegetative vigor, the most sensitive monocot and dicot could not be determined based on study deficiencies and non-definitive endpoints. The RQs for terrestrial plants have been tabulated in **Table 32**. TerrPlant was run for the highest and the lowest application rates and scenarios as a means to provide a range of RQs.

There were RQ exceedances for ornamentals, the use with the highest application rate. The RQs for both monocots and dicots was exceeded for listed and non-listed species for plants in semi-aquatic areas. Risk estimation indicates there is the potential risk for listed and non-listed monocots and dicots in semi-aquatic areas. However, exposure via spray drift alone is not a concern.

Table 32. RQs for non-target monocots and dicots adjacent to propamocarb use areas[1]							
Crop	**Single Max. Application Rate (lbs a.i./A)/ Method of Application**	**Monocot RQ Values**					
		Spray Drift Only		**Runoff and Spray Drift (Dry Areas)**		**Runoff and Spray Drift (Semi-Aquatic Areas)**	
		Non-listed Species	**Listed Species**	**Non-listed Species**	**Listed Species**	**Non-listed Species**	**Listed Species**
Ornamentals	64.3 Ground	<0.1	<0.1	0.48	0.48	**4.10**	**4.10**
Turf	8.2 Aerial/ Chemigation	<0.1	<0.1	0.1	0.10	0.56	0.56
Curcurbits	0.90 Aerial/ Chemigation	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
[1]**Bolded** values exceed LOC; LOC for listed and non-listed species = 1							

4.3 Risk Description

4.3.1 Risk to Aquatic Organisms

A summary of the maximum propamocarb acute and chronic RQ values derived for aquatic organisms is shown in **Table 33**; as such, there were no RQs that exceeded the Agency acute or chronic LOCs for aquatic organisms.

For freshwater fish, the most sensitive endpoints are the rainbow trout LC_{50} > 99 ppm and fathead minnow NOAEC = 6.3 ppm. For estuarine/marine fish the most sensitive endpoint is LC_{50} > 96.8 ppm (sheepshead minnow acute toxicity). The maximum peak EEC used in calculating acute RQs for freshwater and estuarine/marine fish is appreciably lower than the acute endpoints at 2150 ppb (2.150 ppm) resulting in a maximum acute RQ of 0.022; the maximum 60-day EEC used in calculating chronic RQs for freshwater and estuarine/marine fish is 708 ppb (0.708 ppm) resulting in a maximum RQ of 0.112.

For freshwater invertebrates, the most sensitive endpoints are EC_{50} > 103.4 ppm (daphnia acute toxicity) and NOAEC = 9.3 ppm (chronic daphnia toxicity). For estuarine/marine invertebrates the most sensitive endpoint is EC_{50} = 39.2 ppm (eastern oyster acute toxicity). The maximum peak EEC used in calculating acute RQs for freshwater and estuarine/marine invertebrates is appreciably lower than the acute endpoints are 2150 ppb (2.150 ppm) resulting in a maximum RQ of 0.021; the maximum 21-day EEC used in calculating chronic RQs for freshwater and estuarine/marine invertebrates is 1300 ppb (1.3 ppm) resulting in a maximum RQ of 0.140.

Overall propamocarb ranges from practically non-toxic to slightly toxic to aquatic organisms. This toxicity profile is consistent with mode of action of propamocarb HCl. It is important to note, that all acute endpoints used in risk assessment were non-definitive greater than values, thus all risk quotients calculated using these number can be considered to be conservative estimates of risk. The highest acute and chronic RQs result from use information ornamentals, which are an order of magnitude higher than most agricultural uses of the chemical.

Table 33. Summary of aquatic animal risk profile for Propamocarb

Exposure	FW Fish RQ	SW Fish RQ	FW Invert. RQ	SW Invert. RQ
Acute	0.02	0.02	0.02	0.06
Chronic	0.11	NA	0.14	NA

RQ values based on the maximum aquatic EECs derived from the FLnurserySTD_V2_+80 exposure scenario; see Risk Estimation **Section 5.1** for derivation of these RQ values

A summary of the maximum propamocarb RQ values derived for aquatic nonvascular and vascular plants across all use patterns is shown in **Table 34**. There were no RQs that exceeded the Agency LOC of 1.0 for listed or non-listed species.

For nonvascular plants the most sensitive endpoints are EC_{50} >170 ppm and a NOAEC = 71 ppm (*Selenastrum capricornutum)*. For vascular plants, the most sensitive endpoints are EC_{50} = 476.1 ppm and a NOAEL = 269.1 ppm (duckweed). The maximum peak EEC used in calculating RQs for vascular and nonvascular plants is lower than the EC_{50} and NOAEC at 2,150 ppb (2.15 ppm). The EC_{50} is used in calculating RQ for non-listed species and presented a maximum RQ of 0.03 for nonvascular plants and 0.01 for vascular plants. The NOAEC and NOAEL are used in calculating RQs for listed species and presented a maximum RQ of 0.01 for nonvascular plants and <0.01 vascular plants.

Table 34. Summary of aquatic plant risk profile for Propamocarb

Exposure	**Nonvascular Plants**	**Vascular Plants**
Listed	0.01	<0.01
Non-listed	0.03	0.01

RQ values based on the maximum aquatic EECs derived from the FLnurserySTD_V2_+0 exposure scenario; see Risk Estimation **Section 5.1** for derivation of these RQ values

4.3.2 Risk to Terrestrial Organisms

A summary of the maximum propamocarb acute and chronic RQ values derived for terrestrial taxa across all registered use patterns is shown in **Table 35**.

For avian species, the most sensitive acute toxicity study resulted in an LD_{50} >2000 mg/kg-bw (northern bobwhite); it is important to remember the results of risk estimation are considered to be an upper bound estimate and representative of the highest RQ. The most sensitive dietary toxicity study resulted in an LC_{50} = 4160 mg/kg-diet (mallard). These studies show propamocarb to be practically non-toxic to slightly toxic to avian species on acute dose or dietary basis. There were a number of RQ exceedances on an acute, dietary and chronic basis. These exceedances are associated with the uses highest application rates, as well as small organisms consuming short grass. The highest application rates are associated with uses on ornamentals and turf; there is both a high use rate and a low use rate for turf, the lower one (@ 2.12 lb ai/A) is used preventatively. This lower use rate has only one acute estimate of risk that exceeds the LOC. Both dose and dietary based RQs exceeded the Agency's LOC for acute and chronic thresholds, indicating a potential for risk for the registered uses for propamocarb.

Chronic risk to birds as a result of exposure to propamocarb is a concern. The Agency LOC of 1.0 was exceeded for every use across nearly all feeding strategies (with the exception of Fruits, pods, seeds etc.). The maximum RQ associated with the maximum application rate, ornamentals, was 115.47; the maximum RQ associated with the minimum application rate was 2.84.

Additionally, based on the results of STIR, there is risk to avian species associated with use on ornamentals; exposure via inhalation was a potential risk based on the ratio of droplet inhalation dose to the adjusted inhalation LD_{50}. This is considered an uncertainty as we have no additional data to further address this potential risk.

For mammals, the most sensitive acute toxicity study resulted in an LD_{50} > 2000 mg a.i/kg-bw; it is important to remember the results of risk estimation are considered to be an upper bound estimate and representative of the highest RQ. The most sensitive chronic toxicity study resulted in a NOAEL =1250 mg/kg-diet, based on decreased body weight. These studies show propamocarb to be practically non-toxic to mammals on an acute basis. Both the dose based and dietary based RQs exceeded Agency LOCs for acute and chronic thresholds. Both dose and dietary-based chronic RQs exceeded the chronic LOC of 1 for mammals indicating a potential for risk for the registered uses of propamocarb. The highest application rates are associated with uses on ornamentals and turf; there is both a high use rate and a low use rate for turf, the lower one (@ 2.12 lb ai/A) is used preventatively. There were no acute RQs that exceeded the LOC at this use rate; the dose-based chronic RQs were still exceeded across all bird sizes and feeding strategies.

Chronic risk to mammals as a result of exposure of exposure to propamocarb is a concern. The Agency LOC of 1.0 was exceeded for mammals on a dose-based and dietary-based chronic basis for uses beyond just those with the highest application rates. Chronic dose based risk shows RQs above 1.0 for all feeding strategies (with the exception of seeds and grains) for nearly all uses, across all sized mammals. For chronic dose based risk, a small mammal consuming short grass, the RQs range from 4.93 to 200.36; a large mammal consuming short grass presents RQs ranging from 2.26 to 42.05. These RQs are well above the LOC and present a concern for mammals exposed to propamocarb on a chronic basis.

There is uncertainty concerning the acute RQs for both mammals and birds; the endpoints used in risk quotient formulation were non-definitive greater than values. Because these values were used in RQ calculations, the acute RQs can be considered to be conservation and an indication of the "worst case scenario." Regardless, there are numerous acute RQs that are well above the LOC.

The agricultural uses of propamocarb show chronic exceedances for birds and mammals that are significantly lower than those presented for turf and ornamentals. Additional information on the amount of propamocarb associated with the different agricultural uses as compared with the total usage of propamocarb could help provide an estimation of the percent of propamocarb used on ornamentals and turf.

A potential refinement to further understand the toxicity of propamocarb to birds and mammals would be the submission of a foliar dissipation half-life study. This assessment presents modeled results using a default value of 35-days; an actual value of how propamocarb dissipates in the field would help refine these estimates.

Table 35. Summary of the Avian and Mammalian Risk Profile for Propamocarb

Exposure	Avian Dose RQ	Avian Dietary RQ	Mammalian Dose RQ	Mammalian Dietary RQ
Acute	<22.82	6.94	<6.26	NA
Chronic	NA	115.54	**200.36**	**23.09**

RQ values based on the terrestrial EECs derived from use on ornamentals; see Risk Estimation for derivation of these RQ values
Bolded values exceed LOC risk to non-listed species
Shaded box indicates LOC risk to listed species

Terrestrial Invertebrates (Honey Bees)

As indicated above, the existing Tier 1 assessment does not indicate a potential for risk to individual adult bees from the acute contact route; there was an LOC exceedance for bees for the use of propamocarb on ornamentals.

Currently, the only Tier 1 (laboratory) toxicity data for bees are available with propamocarb for acute contact exposures with adult bees. No Tier 1 data are available for quantifying the acute and chronic toxicity of propamocarb to larval bees. Furthermore, no Tier 1 data are available to evaluate the chronic toxicity to adult bees. Therefore, the following Tier 1 toxicity data would allow for a complete evaluation of effects of propamocarb to bees, including solitary bees.

- Acute toxicity (single dose) to larval bees (OECD 237)
- Acute oral toxicity to adult bees
- 21-d chronic toxicity (repeat dose) to larval bees (OECD draft guideline available)[13]
- 10-d chronic toxicity to adult bees (OECD draft guideline available).[14]

Tier II (feeding/semi-field/pollen and nectar residue) and Tier III (full field) studies may be needed, contingent upon the results of lower tier studies. Tier II and III data which could be required are as follows:

- Semi-field testing for pollinators (Tunnel or colony feeding studies) (Tier II)
- Field Trial of residues in pollen and nectar (Tier II)
- Field testing for pollinators (Tier III)

Terrestrial Plants

The terrestrial plant studies were conducted using a single application of 8.0 lbs ai/A; this rate corresponds with the second highest application rate, associated with use on turf. It should be noted that this application rate is much higher than all other application rates associated with agricultural uses.

The risk profile for propamocarb to terrestrial plants has been summarized in **Table 36**. The most sensitive monocot and dicot could not be determined for vegetative vigor or seedling emergence. Since the EC_{25} and NOAEC were not definitively established (>8.0 lb ai/A), there is uncertainty regarding the estimated risk of propamocarb applications to the vegetative vigor and seedling emergence of terrestrial plants. The maximum use rate was modeled for terrestrial plants and presented RQs that exceed the LOC for semi-aquatic areas; all other application rates below this do not result in any exceedances. An additional uncertainty presented is that even though a >25% effect was no observed in the Tier I plant studies, some of the species were close to seeing a 25% effect level; given that the application rate for ornamentals is above the application rate for which the limit test was dosed at, there are potential greater risks for non-listed, and listed species.

Table 36. Summary of Terrestrial Plant Risk Profile for Propamocarb

Exposure	Monocot RQ	Dicot
Listed	**4.42**	**4.42**
Non-listed	**4.42**	**4.42**

[13] Available at:
http://www.oecd.org/env/ehs/testing/Honeybee%20larval%20rep%20expo_REV%20following%20April%202015%20expert%20meeting_Draft%2020%20July%202015.pdf
[14]Available at:
https://www.oecd.org/env/ehs/testing/Draft%20TG%2010d%20Honeybee%20feeding_Feb%202016.pdf

RQ values based on the RQs derived using TerrPlant associated with use on ornamentals; see Risk Estimation **Section 5.1** for derivation of these RQ values **Bolded values** represent LOC exceedances

4.4 Federally Threatened and Endangered (Listed) Species of Concern

Consistent with EPA's responsibility under the Endangered Species Act (ESA), the Agency will evaluate risks to federally listed threatened and endangered (listed) species from registered uses of pesticides in accordance with the Joint Interim Approaches developed to implement the recommendations of the April 2013 National Academy of Sciences (NAS) report, *Assessing Risks to Endangered and Threatened Species from Pesticides*. The NAS report outlines recommendations on specific scientific and technical issues related to the development of pesticide risk assessments that EPA and the Services must conduct in connection with their obligations under the ESA and FIFRA. EPA will address concerns specific to propamocarb in connection with the development of its final registration review decision for propamocarb.

In November 2013, EPA, the U.S. Fish and Wildlife Service, National Marine Fisheries (the Services), and USDA released a white paper containing a summary of their joint Interim Approaches for assessing risks to listed species from pesticides. These Interim Approaches were developed jointly by the agencies in response to the NAS recommendations, and reflect a common approach to risk assessment shared by the agencies as a way of addressing scientific differences between the EPA and the Services. Details of the joint Interim Approaches are contained in the November 1, 2013 white paper, *Interim Approaches for National-Level Pesticide Endangered Species Act Assessments Based on the Recommendations of the National Academy of Sciences April 2013 Report.*

Given that the agencies are continuing to develop and work toward implementation of the Interim Approaches to assess the potential risks of pesticides to listed species and their designated critical habitat, this document does not describe the specific ESA analysis, including effects determinations for specific listed species or designated critical habitat, to be conducted during registration review. While the agencies continue to develop a common method for ESA analysis, the planned risk assessment for the registration review of propamocarb will describe the level of ESA analysis completed for this particular registration review case. This assessment will allow EPA to focus its future evaluations on the types of species where the potential for effects exists, once the scientific methods being developed by the agencies have been fully vetted. Once the agencies have fully developed and implemented the scientific methods necessary to complete risk assessments for listed species and their designated critical habitats, these methods will be applied to subsequent analyses of propamocarb as part of completing this registration review.

4.5 Endocrine Disruptor Screening Program

As required by FIFRA and FFDCA, EPA reviews numerous studies to assess potential adverse outcomes from exposure to chemicals. Collectively, these studies include acute, subchronic and chronic toxicity, including assessments of carcinogenicity, neurotoxicity, developmental, reproductive, and general or systemic toxicity. These studies include endpoints which may be susceptible to endocrine influence, including effects on endocrine target organ histopathology, organ weights, estrus cyclicity, sexual maturation, fertility, pregnancy rates, reproductive loss, and sex ratios in offspring. For ecological hazard assessments, EPA evaluates acute tests and chronic studies that assess growth, developmental and reproductive effects in different taxonomic groups. As part of Problem Formulation for the Registration review of propamocarb, EPA reviewed these data and selected the most sensitive endpoints for relevant risk assessment scenarios from the existing hazard database. However, as required by FFDCA section 408(p), propamocarb is subject to the endocrine screening part of the Endocrine Disruptor Screening Program (EDSP).

EPA has developed the EDSP to determine whether certain substances (including pesticide active and other ingredients) may have an effect in humans or wildlife similar to an effect produced by a "naturally occurring estrogen, or other such endocrine effects as the Administrator may designate." The EDSP employs a two-tiered approach to making the statutorily required determinations. Tier 1 consists of a battery of 11 screening assays to identify the potential of a chemical substance to interact with the estrogen, androgen, or thyroid (E, A, or T) hormonal systems. Chemicals that go through Tier 1 screening and are found to have the potential to interact with E, A, or T hormonal systems will proceed to the next stage of the EDSP where EPA will determine which, if any, of the Tier 2 tests are necessary based on the available data. Tier 2 testing is designed to identify any adverse endocrine-related effects caused by the substance, and establish a dose-response relationship between the dose and the E, A, or T effect.

Under FFDCA section 408(p), the Agency must screen all pesticide chemicals. Between October 2009 and February 2010, EPA issued test orders/data call-ins for the first group of 67 chemicals, which contains 58 pesticide active ingredients and 9 inert ingredients. A second list of chemicals identified for EDSP screening was published on June 14, 2013 and includes some pesticides scheduled for registration review and chemicals found in water. Neither of these lists should be construed as a list of known or likely endocrine disruptors.

Propamocarb was not on List 1 or 2. For further information on the status of the EDSP, the policies and procedures, the lists of chemicals, future lists, the test guidelines and the Tier 1 screening battery, please visit our website.[15]

5.0 Uncertainties, Limitations and Data gaps

5.1 Environmental Fate

The environmental fate database for propamocarb is substantially complete, as evidenced by the presence of most environmental fate laboratory and field studies.

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15 http://www.epa.gov/endo/

5.2 Ecological Effects

There are a number of areas of uncertainty in the aquatic and terrestrial risk assessments. The toxicity assessment for terrestrial and aquatic plants and animals is limited by the number of species tested in the available toxicity studies. Use of toxicity data on representative species does not provide information on the potential variability in susceptibility to acute and chronic exposures.

For each proposed use, the risk assessment is based on the maximum application rate on the proposed label. The frequency at which actual uses approach these maximum scenarios is dependent on the resistance to the pesticide, the timing of applications, and market forces. Exposure and risks could be overestimated if the actual application rates, frequency of application, or number of applications are lower than the input parameters used for the conservative exposure scenario that was modeled. However, if there are conditions under which there is more than one growing season for a crop within a single year, exposure estimates and risk to aquatic and terrestrial organisms could be significantly underestimated.

Furthermore, there is uncertainty regarding the actual toxicity of propamocarb HCl to nearly all organisms on an acute basis; there are no acute studies for which definitive values are available. Definitive values are necessary for RQ calculations because they provide a single toxicological endpoint, whereas a non-definitive endpoint provides a range of toxicological endpoints in that it includes all values above the endpoint (greater than) or below the endpoint (less than) in the estimation of toxicity. All acute RQs presented in this assessment are considered to be an upper bound estimate of risk, and thus conservative; there is great uncertainty understanding the actual toxicity of propamocarb to aquatic and terrestrial organisms.

5.2.1 Terrestrial Exposure Assessment

This risk assessment relies on the best available estimates of environmental fate and physicochemical properties, maximum application rate of propamocarb, maximum number of applications, and the shortest interval between applications. However, several uncertainties and model limitations are noted and should be considered in interpreting the results of this terrestrial risk assessment. The 35-day foliar dissipation half-life was used in T-REX calculations. Use of an actual foliar dissipation half-life specific to propamocarb could refine the EEC estimates and thus refine the RQs.

5.2.2 Routes of Exposure

Dietary Exposure

Risk assessments for spray applications of pesticides assume that 100% of the diet is relegated to single food types foraged only from treated fields. These assumptions are likely to be conservative for many species and will tend to overestimate potential risks. The assumption of 100% diet from a treated area may be realistic for acute exposures, but long-term exposures modeled as single food types composed entirely of material from a treated field is uncertain.

Dermal Exposure

The screening assessment does not consider propamocarb dermal exposure to terrestrial organisms. The Agency is actively pursuing modeling techniques to account for dermal exposure via direct application of spray and by incidental contact with contaminated vegetation, soil and water.

Drinking Water

The screening assessment does not consider propamocarb water through drinking water. The Screening Imbibition Program (SIP, v.1.0, December 2010) indicates that exposure through drinking water alone may be a concern for avian species. This not currently further modeled or taken into account in this assessment.

5.2.3 Age Class and Sensitivity of Effects Thresholds

It is generally recognized that test organism age may have a significant impact on the observed sensitivity to a toxicant. The screening risk assessment acute toxicity data for fish are collected on juvenile fish and aquatic invertebrate acute testing is performed on recommended immature age classes. Similarly, acute dietary testing with birds is also performed on juveniles, with mallard being 5-10 days old and quail at 10-14 days of age.

Testing of juveniles may overestimate the toxicity of direct acting pesticides in adults. As juvenile organisms do not have fully developed metabolic systems, they may not possess the ability to transform and detoxify xenobiotics equivalent to the older/adult organism. The screening risk assessment has no current provisions for a generally applied method that accounts for this uncertainty. In so far as the available toxicity data may provide ranges of sensitivity information with respect to age class, the risk assessment uses the most sensitive life-stage information as the conservative screening endpoint.

5.2.4 Lack of Effects Data for Amphibians and Reptiles

Currently, toxicity studies on amphibians and reptiles are not required for pesticide registration. Since these data are lacking, the Agency uses fish as surrogates for aquatic phase amphibians and birds as surrogates for terrestrial phase amphibians and reptiles. If other species are more or less sensitive to propamocarb than the surrogates, risks may be under- or overestimated, respectively. The Agency is not limited to a base set of surrogate toxicity information in establishing risk assessment conclusions. The Agency also considers toxicity data on non-standard test species when available. Further research is needed to determine whether, in general, reptiles and terrestrial-phase amphibians are suitably represented by bird species in assessing risks for propamocarb and fish are an appropriate surrogate for aquatic-phase amphibians.

5.2.5 Lack of Effects Data for Honeybees

Currently, there are a number of data gaps conducted measuring the toxicity of propamocarb to larval honeybees on an acute and chronic basis, as well as adult bees on a chronic basis. These toxicity studies help estimate the risk to a honeybee through the entire life span. These study requirements are outlined in the Guidance for Assessing Pesticide Risks to Bees. Current data for propamocarb show minimal toxicity to bees, but data on honey bee larvae and chronic toxicity to adults will be helpful in estimating risk to honeybees in the future.

5.2.6 Use of the Most Sensitive Species Tested

Although the screening risk assessment relies on a selected toxicity endpoint from the most sensitive species tested, it does not necessarily mean that the selected toxicity endpoints reflect sensitivity of the most sensitive species existing in a given environment. The relative position of the most sensitive species tested in the distribution of all possible species is a function of the overall variability among species to a particular chemical. The relationship between the sensitivity of the most sensitive tested species versus wild species (including listed species) is unknown and a source of significant uncertainty. In addition, in the case of listed species, there is uncertainty regarding the relationship of the listed species' sensitivity and the most sensitive species tested.

In the risk assessment, RQs were only calculated for the most sensitive dietary class relevant to the organisms assessed. For most organisms, not enough data is available to conclude that birds or mammals may not exclusively feed on a dietary class for at least some time period. However, most birds and mammals consume a variety of dietary items and thus the RQ will overestimate risk to those organisms. Additionally, some organisms will not feed on all of the dietary classes. For example, many amphibians would only consume insects and not any plant material.

5.2.7 Sublethal Effects

When assessing acute risk, the screening risk assessment relies on the acute mortality endpoint as well as a suite of sublethal responses to the pesticide, as determined by the testing of species response to chronic exposure conditions and subsequent chronic risk assessment. Consideration of additional sublethal data in the effects determination is exercised on a case-by-case basis and only after careful consideration of the nature of the sublethal effect measured and the extent and quality of available data to support establishing a plausible relationship between the measure of effect (sublethal endpoint) and the assessment endpoints. However, the full suite of sublethal effects from valid open literature studies is considered for the characterization purposes.

To the extent to which sublethal effects are not considered in this assessment, the potential direct and indirect effects of propamocarb on listed species may be underestimated.

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USEPA 2009b. Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides, Version 2.1. Office of Prevention, Pesticides and Toxic Substances, Office of Pesticide Programs, Environmental Fate and Effects Division, October 22, 2009 and issued November 10, 2009. Available online at: http://www.epa.gov/oppefed1/models/water/input_parameter_guidance.htm (accessed October 18, 2013).

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Appendix A. Available Data to Support Propamocarb

Eco Effects Bibliography MRID

71-1 Avian Single Dose Oral Toxicity

MRID	Citation Reference
41278108	Ross, D. et al. (1977) W1-Propamocarb HCL: The Acute Oral Toxicity (LD50) of ZK 66 752 to The Mallard Duck: Lab Project Number: SHG/153/WL/77833. Unpublished study prepared by Huntingdon Research Centre 11 p.
41278109	Ross, D. et al. (1977) W2 Propamocarb: The Acute Oral Toxicity (LD50) of ZK 66 752 to the Ring-Necked Pheasant: Lab Project Number: SHG/153/WL/77831. Unpublished study prepared by Huntingdon Research Centre. 13 p.
46145210	Teunissen, M. (2002) Acute Oral Toxicity Study in Northern Bobwhite with Proplant (Propamocarb HCl 722 g/l). Project Number: 327004, 100971. Unpublished study prepared by Notox B.V. 78 p.
42567901 Added	Hakin, B. (1992) Previcur N SL: Bobwite Quail Acute Oral Toxicity (LD50) Study: Lab Project Number: SMS 406/921159. Unpublished study prepared by Huntingdon Research Centre Ltd. 25 p.

71-2 Avian Dietary Toxicity

MRID	Citation Reference
41278110	Ross, D. et al. (1977) W3 Propamocarb: The Subacute Toxicity (LC50) Of ZK 66 752 to the Mallard Duck: Lab Project Number: SHG/155/WL/77611. Unpublished study prepared by Huntingdon Research Centre. 15 p.
41278111	Ross, D. et al. (1977) W4 Propamocarb HCL: The Subacute Toxicity (LC50) of ZK 66 752 to the Pheasant: Lab Project Number: SHG/153/WL/77741. Unpublished study prepared by Huntingdon Research Centre. 16 p.
45894212	Miller, V. (2002) Proplant--Dietary Toxicity Test with the Mallard Duck (Anas platyrhynchos): Lab Project Number: 13763.4102. Unpublished study prepared by Springborn Smithers Laboratories. 96 p.
46145211	Teunissen, M. (2001) 5-Day Dietary Toxicity Study in Bobwhite Quail with Proplant (Propamocarb HCl 722 g/l). Project Number: 329783, 100971. Unpublished study prepared by Notox B.V. 71 p.
42567902 Added	Hakin, B. (1992) Previcur N SL: Mallard Duck Subacute Dietary Toxicity (LC50) Study: Lab Project Number: SMS 407/921085.

	Unpublished study prepared by Huntingdon Research Centre Ltd. 20 p.
42567903 Added	Hakin, B. (1992) Previcur N SL: Bobwhite Quail Subacute Dietary Toxicity (LC50) Study: Lab Project Number: SMS 408/921086. Unpublished study prepared by Huntingdon Research Centre Ltd. 21 p.

71-4 Avian Reproduction

MRID	Citation Reference
44538501	Mitchell, L.; Martin, K.; Beavers, J. et al. (1998) W148-1 Propamocarb: Propamocarb HCL Liquid Concentrate 780g/l Bobwhite Quail Dietary Reproduction Study: Lab Project Number: TOX/98/186-33: TOX 94149: 312-109. Unpublished study prepared by Wildlife International Ltd. 254 p.
44538502	Mitchell, L.; Martin, K.; Beavers, J. et al. (1998) W149-1 Propamocarb: Propamocarb HCL Liquid Concentrate 780g/l Mallard Duck Dietary Reproduction Study: Lab Project Number: TOX/98/186-35: TOX 94151: 312-110. Unpublished study prepared by Wildlife International Ltd. 251 p.
46145212	Teunissen, M. (2002) Reproduction Study in Bobwhite Quail with Proplant (Propamocarb HCl 722 g/l)(by Dietary Admixture). Project Number: 295526, 100971. Unpublished study prepared by Notox B.V. 210 p.
46145213	Miller, V. (2002) Proplant - Reproductive Toxicity Test with Mallard Duck (Anas platyrhynchos). Project Number: 13763/4100, 03120/FIFRA/OECD/MALLARDREPRO. Unpublished study prepared by Springborn Smithers Laboratories. 246 p.

72-1 Acute Toxicity to Freshwater Fish

MRID	Citation Reference
41278112	Fraser, W.; Pell, E. (1977) W37 Propamocarb HCL: The Acute Toxicity of SN 66752 to the Mirror Carp (Cyprinus caprio) and the Rainbow Trout (Salmo gairdneri): Lab Project Number: SHG/156/77919. Unpublished study prepared by Huntingdon Research Centre. 21 p.
41278113	Fraser, W.; Pell, E. (1977) W38 Propamocarb HCL: The Acute Toxicity of SN 66752 to the Bluegill Sunfish (Lepomis macrochirus) and the Rainbow Trout (Salmo gairdneri): Lab Project Number: SHG/157/77754. Unpublished study prepared by Huntingdon Research Centre. 17 p.
42083102	Schupner, J.; Stachura, B. (1991) The Static Acute Toxicity of **Propamocarb** to the Bluegill Sunfish, Lepomis machrochirus: ?Propa-

	mocarb W89|: Lab Project Number: 510 AV. Unpublished study prepared by NOR-AM Chemical Co., Environmental Sciences Dept. 41 p.
42083103	Schupner, J.; Stachura, B. (1991) The Static Acute Toxicity of Propamocarb-HCL to the Rainbow Trout, Oncorhynchus mykiss: ?Propamocarb W92|: Lab Project Number: 509 AV. Unpublished study prepared by NOR-AM Chemical Co. 42 p.
45894301	Migchielsen, I. (2001) 96-Hour Acute Toxicity Study in Bluegill Sunfish with Proplant (Propamocarb HCl 722 g/l) (Static): Lab Project Number: 329748. Unpublished study prepared by Notox B.V. 32 p. {OPPTS 850.1075}
45894302	Bogers, M. (1996) 96-Hour Acute Limit Study in Rainbow Trout with Proplant (Semi-Static): Lab Project Number: 161303: 180798. Unpublished study prepared by NOTOX. 24 p.

72-2 Acute Toxicity to Freshwater Invertebrates

MRID	Citation Reference
45894303	Bogers, M. (1996) Acute Limit Study in Daphnia magna with Proplant: Lab Project Number: 161314: 181924. Unpublished study prepared by NOTOX. 24 p.
47370	Vilkas, A.E.; Morrissey, A.E. (1979) The Acute Toxicity of SN 66752 (Previcur N) 67.3% Active Ingredient to the Water Flea~Daphnia~ ~magna~Straus: UCES Project No. 11506-74-05. (Unpublished study received Oct 9, 1979 under 2139-EX-24; prepared by Union Carbide Corp., submitted by Nor-Am Agricultural Products, Inc., Naperville, Ill.; CDL:241124-C)
42567904 Added	Schupner, J.; Stachura, B. (1992) Propamocarb/W111: The Acute Toxicity Propamocarb-HC1 to Daphnia magna in a Static System: Lab Project Number: 512AV. Unpublished study prepared by Nor-AM Chemical Co. 41 p.

72-3 Acute Toxicity to Estuarine/Marine Organisms

MRID	Citation Reference
42083104	Holmes, C.; Peters, G. (1991) W91 Propamocarb-HCL: a 96-Hour Shell Deposition Test with the Eastern Oyster (Crassostrea virginica): Final Report: Lab Project Number: 244A-102A: 503 AV. Unpub- lished study prepared by Wildlife International, Ltd. 45 p.
45894304	Putt, A. (2001) Proplant (Propamocarb HCl 722 g/l SL)--Acute Toxicity to Sheepshead Minnow (Cyprinodon variegatus) under Static Conditions: Lab Project Number: 13763.6104: 122198. Unpublished study prepared by Springborn Laboratories, Inc. 52 p.

45894305	Dionne, E. (2001) Proplant (Propamocarb HCl 722 g/l SL)--Acute Toxicity to Eastern Oysters (Crassostrea virginica) Under Flow-Through Conditions: Lab Project Number: 13763.6102: 031301. Unpublished study prepared by Springborn Laboratories, Inc. 62 p. {OPPTS 850.1025}
45894306	Putt, A. (2001) Proplant (Propamocarb HCl 722 g/l SL)--Acute Toxicity to Mysids (Americamysis bahia) Under Static Conditions: Lab Project Number: 13763.6101: 032001. Unpublished study prepared by Springborn Laboratories, Inc. 55 p.
41834603 Added	Schnupner, J. (1991) The Static Acute Toxicity of Propamocarb-HCL to the Sheepshead Minnow, Cyprinodon variegatus: Lab Project No: 504AV. Unpublished study prepared by NOR-AM Chemical Co., Research Center. 43 p.
41834604 Added	Schupner, J. (1991) The Static Acute Toxicity of Propamocarb-HCL to the Mysid Shrimp, Mysidopsis bahia: Lab Project Number: 500AV. Unpublished study prepared by NOR-AM Chemical Co., Research Center. 39 p.

72-4 Fish Early Life Stage/Aquatic Invertebrate Life Cycle Study

MRID	Citation Reference
41684301	Mullerschon, H. (1990) W76 Propamocarb HCL: Influence of Previcur N (Propamocarb hydrochloride Techn.) on the Reproduction of Daphnia magna: Lab Project Number: 167400. Unpublished study prepared by CCR Cytotest Cell Research GmbH & Co. KG. 41 p.
41834602 Added	Wuthric, V. (1990) Previcur N Propamocarb-HCL Techn: 21-Day Prolonged Toxicity Study Rainbow Trout Under Flow-through Condi- tions: Lab Project Number: 223086: TB 88032. Unpublished study prepared by RCC Umweltchemie Ag. 49 p.
42083105	Graves, W.; Peters, G. (1991) W90 Propamocarb-HCL: an Early Life-Stage Toxicity Test with the Fathead Minnow (Pimphales promelas) :Final Report: Lab Project Number: 244A-101: 501 AV. Unpub- lished study prepared by Wildlife International, Ltd. 70 p.
44557801	Young, B.; Ruff, D. (1996) Propamocarb hydrochloride; Water-Miscible Concentrate; 68.2% w/w (738 g/L): Effects on Life-Cycle of the Water flea (Daphnia magna) in a Static Renewal System: Lab Project Number: 516AV: O008A/U037: A89730. Unpublished study prepared by AgrEvo USA Co. 62 p.
45727801	Machado, M. (2002) Propamocarb Technical--Full Life-Cycle Toxicity Test with Water Fleas, Daphnia Magna, Under Static-Renewal Conditions: Lab Project Number: 13726.6183: 02AV34315. Unpublished study prepared by Springborn Smithers Laboratories. 73 p.
45894307	Corman, I. (2002) Proplant: Early Life-Stage Toxicity Test with Fathead Minnow (Pimephales promelas) under Flow-Through Conditions: Final Report: Lab Project Number: 1038.004.122.

	Unpublished study prepared by Springborn Laboratories (Europe) AG. 74 p. {OPPTS 850.1400}
45894308	Bogers, M. (1998) Daphnia magna Reproduction Test with Proplant (Semi-Static): Lab Project Number: 220771. Unpublished study prepared by NOTOX. 29 p.

122-1 Seed Germination/Seedline Emergence and Vegetable Vigor

MRID	Citation Reference
45894310	Geuijen, W. (2002) Terrestrial Plant Toxicity Test, Tier 1: Seedling Emergence, with Proplant(Propamocarb HCL 722 g/l): Lab Project Number: 327048. Unpublished study prepared by NOTOX B.V. 44 p. {OPPTS 850.4000 and 850.4100}
45894311	Geuijen, W. (2001) Terrestrial Plant Toxicity Test, Tier 1: Vegetative Vigor, with Proplant(Propamocarb HCL 722 g/l): Lab Project Number: 327059. Unpublished study prepared by NOTOX B.V. 44 p. {OPPTS 850.4000 and 850.4150}
41834605 Added	Downey, S. (1991) Investigation into the Phytotoxic Effects of Propamocarb.HCL on Seed Germination (Tier 1): Lab Project No: 505 AV. Unpublished study prepared by NOR-AM Chemical Co. 45 p.
41834606 Added	Downey, S. (1991) Investigation into the Phytotoxic Effects of Propamocarb.HCL on Seedling Emergence (Tier 1): Lab Project No: 506/AV. Unpublished study prepared by NOR-AM Chemical Co. 62 p.
41834607 Added	Downey, S. (1991) Investigation into the Phytotoxic Effects of Propamocarb.HCL on Vegetative Vigor (Tier 1): Lab Project No: 507/AV. Unpublished study prepared by NOR-AM Chemical Co. 90 p.

122-2 Aquatic plant growth

MRID	Citation Reference
41684302	Hansveit, A.; Oldersma, H. (1990) W42/2 Propamocarb-HCl: Wildlife and Environment, Effect of Previcur N on the Growth of the Green Alga Scenedesmus Quadricauda (Nen 6506): Lab Project Number: T-NO/R/90/399. Unpublished study prepared by TNO Division of Technology. 28 p.
44187802	Christ, M.; Ruff, D. (1996) Propamocarb Hydrochloride; Water-Miscible Concentrate; 68.2% w/w (738 g/l): Toxicity to Duckweed (Lemna gibba, G3) in a Static Renewal System: Lab Project Number: 522AV: A89710: PROPAMOCARB/W136-1. Unpublished study prepared by AgrEvo USA Co. 43 p.
45525701	Hoberg, J. (2001) Propamocarb Hydrochloride--Toxicity to the Freshwater Green Alga, Pseudokirchneriella subcapitata: Lab Project

	Number: 13726.6139: B003349. Unpublished study prepared by Springborn Laboratories, Inc. 71 p. {OPPTS 850.5400}
45894312	Bogers, M. (1996) Fresh Water Algal Growth Inhibition Test with Proplant: Lab Project Number: 165364. Unpublished study prepared by NOTOX. 36 p.
45894313	Bogers, M. (2001) A 7-Day Aquatic Plant Toxicity Test Using Lemna minor with Proplant (Propamocarb HCl 722 g/L): Lab Project Number: 329254. Unpublished study prepared by NOTOX. 47 p.

123-1 Seed germination/seedling emergence and vegitative vigor

MRID	Citation Reference
44187801	Christ, M.; Ruff, D. (1996) Propamocarb Hydrochloride; Water-Miscible Concentrate; 68.2% w/w (738 g/l): Investigation into the Phytotoxic Effects on Seedling Emergence/Growth of Terrestrial Plants: Lab Project Number: O075/U042: A89755: 511AV. Unpublished study prepared by AgrEvo USA Co. 87 p.
45894309	Geuijen, W. (2002) Terrestrial Plant Toxicity Test, Seed Germination/Root Elongation Toxicity Test with Proplant(Propamocarb HCL 722 g/l): Lab Project Number: 327037. Unpublished study prepared by NOTOX B.V. 80 p. {OPPTS 850.4200}
47370502 Added	Nguyen, D.; Gosch, H. (2005) Non-Target Terrestrial Plants: An Evaluation of the Effects of Propamocarb-fosetylate SL 840 in the Seedling Emergence Test (Tier 1). Project Number: SE05/01, EBPRX020. Unpublished study prepared by Bayer Cropscience Gmbh. 17 p.
47370503 Added	Nguyen, D.; Gosch, H. (2005) Non-Target Terrestrial Plants: An Evaluation of the Effects of Propamocarb-fosetylate SL 840 in the Vegetative Vigour Test (Tier 1). Project Number: VV05/01, EBPRX021. Unpublished study prepared by Bayer Cropscience Gmbh. 17 p.

141-1 Honey bee acute contact

MRID	Citation Reference
44324501	Nengel, S. (1997) Assessment of Side Effects of Proplant to the Honey Bee, Apis mellifera L. in the Laboratory: Final Report: Lab Project Number: 96047/01-BLEU. Unpublished study prepared by GAB Biotechnologie GmbH and IFU Umweltanalytik GmbH. 24 p.
45090810	Waltersdorfer, A. (1997) Propamocarb Hydrochloride Watersoluble Concentrate 722 g/l: Contact Toxicity (LD 50) to Honey Bees (Apis mellifera L.): Lab Project Number: CW97/074: A83753: W140-1. Unpublished study prepared by Hoechst Schering AgrEvo GmbH 15 p {OPPTS 850.3010}

Fate Chemistry Bibliography MRID

161-1 Hydrolysis

MRID	Citation Reference
47369	Klehr, M.; Riemann, J. (1978) Photolysis of PropamocarbxHCL (SN 66 752) in Aqueous Solution: Report No. APC 06/78. (Translation from German; prepared by Fachbereich, submitted by Nor-Am Agri- cultural Products, Inc., Naperville, Ill.; CDL:241124-B)
71295 Or 71460	Klehr, M. (1978) Photolysis of PropamocarbxHCl (SN 66 752) in Aqueous Solution: Rep. No. APC 06/78. (Translation from German; unpublished study received Feb 24, 1981 under 2139-121; prepared by Schering, AG, West Germany, submitted by Nor-Am Agricultural Products, Inc., Naperville, Ill.; CDL:244469-B)
71297	Riemann, J.; Repenthin, W. (1976) Determination of Rates of Hydrolysis of Propamocarb Base at pH 5, 7 and 9: Report No. APC 26/76. (Translation; unpublished study received Feb 24, 1981 under 2139-121; prepared by Schering, AG, West Germany, submitted by Nor-Am Agricultural Products, Inc., Naperville, Ill.; CDL: 244469-D)

161-2 Photodegradation-water

MRID	Citation Reference
46145214	Mullee, D.; Bartlett, A. (1995) Propamocarb Hydrochloride: Determination of Photochemical Degradation. Project Number: 722/014, 722/007A. Unpublished study prepared by Safepharm Laboratories, Ltd. 10 p.
71296 or 71461	Klehr, M. (1980) Photolysis Experiments with Propamocarb-HCl (SN 66 752) in Heat Sterilized Aqueous Solutions. (Unpublished study received Feb 24, 1981 under 2139-121; prepared by Scher- ing, AG, West Germany, submitted by Nor-Am Agricultural Prod- ucts, Inc., Naperville, Ill.; CDL:244469-C)

161-3 Photodegradation-soil

MRID	Citation Reference
45894318	Yeomans, P. (2001) (Carbon 14)-Propamocarb Hydrochloride: Photodegradation on a Soil Surface: Final Report: Lab Project Number: 1669/8: 1669/8-D2149. Unpublished study prepared by Covance Laboratories Ltd. 62 p.

41834608	Tschampel, M. (1990) W78 Propamocarb: The Photodegradation of Propamocarb Hydrochloride on soil surfaces (Schering Code ZK 66 752) on Soil Surfaces. Laboratory Project ID: APC 87/90. Study No. 90/030. Unpublished Study Performed by Schering AG, Berlin, Federal Republic of Germany and Submitted by Nor-Am Chemical Company, Wilington, DE.

162-1 Aerobic soil metabolism

MRID	Citation Reference
71462 or 41278126	Bruhl, R.; Wi, ? (1979) Degradation of Propamocarb Hydrochloride in a Californian Loamy Sand: Report No. R + S 29/79--PA 66 752.71/6. (Unpublished study received Feb 24, 1981 under 2139-121; prepared by Schering AG, West Germany, submitted by Nor-Am Agricultural Products, Inc., Naperville, Ill.; CDL: 244472-E)
71463 or 41278125	Bruhl, R.; Celorio, J.; Wi, ? (1978) Degradation of SN 66 752 in a Loamy Sand: Report No. PA 66 752.71/6. (Unpublished study received Feb 24, 1981 under 2139-121; prepared by Schering AG, West Germany, submitted by Nor-Am Agricultural Products, Inc., Naperville, Ill.; CDL:244472-F)
71464	Bruhl, R.; Celorio, J.; Wi, ? (1980) Degradation of Propamocarb Hydrochloride in German Standard Soils 2.2 and 2.3 at 15^oI C: R + 5 58/80--PA 66 752.71/6. (Unpublished study received Feb 24, 1981 under 2139-121; prepared by Schering AG, West Germany, submitted by Nor-Am Agricultural Products, Inc., Naperville, Ill.; CDL:244472-G)
71467	Iwan, J.; Wi, ? (1980) Metabolism of Propamocarb Hydrochloride by Soil Microorganisms: Behavior in Sterilized and Non-sterilized German Standard Soil 2.2: R + S 48/80--PA 66 752.73/2. **Rept. of progress** no. 2. (Unpublished study received Feb 24, 1981 under 2139-121; prepared by Schering AG, West Germany, sub- mitted by Nor-Am Agricultural Products, Inc., Naperville, Ill., CDL:244472-J)
41278125	Bruhl, R. (1978) W12 Propamocarb HCL: Degradation of SN 66 752 in a Loamy Sand: Lab Project Number: PA/66/752/71/6. Unpublished study prepared by Schering AG. 11 p.
93193034	Chow, N.L. and R.R. Stevens (1990d) Phase 3 Summary of MRID 41278125 (W12) Degradation of SN66752 in a Loamy Sand. Laboratory ID: PA66752 71/6. Unpublished Summary Prepared and Submitted by Nor-Am Chemical Company, Wilmington, DE.
41278126	Bruhl, R. (1979) W13 Propamocarb HCL: Degradation of Propamocarb Hydrochloride in a Californian Loamy Sand: Lab Project Number: 29/79/PA/66/752/71/6. Unpublished study prepared by Schering AG. 10 p.
93193031	Chow, N.L. and R.R. Stevens (1990e) Phase 3 Summary of MRID 41278126 (W13) Degradation of Propamocarb-HC1 in a California Loamy Sand. Laboratory ID: R+S 29/79. Unpublished Summary Prepared and Submitted by Nor-Am Chemical Company, Wilmington, DE.

41278128	Bruhl, R.; Celorio, R. (1986) W58 Propamocarb HCL: Degradation of Propamocarb Hydrochloride in a Loamy Sand after Repeated (Twofold) Application: Lab Project Number: UPSR/1/86/PA/66752/ 71. Unpublished study prepared by Schering AG. 26 p.
93193033	Chow, N.L. and R.R. Stevens (1990g) Phase 3 Summary of MRID 41278128 (W58) Degradation of Propamocarb HC1 in a Loamy Sand after Repeated Application: Laboratory ID: UPSR/1/86 PA/66752/ 71. Unpublished Summary Prepared and Submitted by Nor-Am Chemical Company, Wilmington, DE.
45894319	Schnoder, F. (2002) (Carbon 14)Propamocarb Hydrochloride: Aerobic Route and Rate of Soil Degradation: Final Report: Lab Project Number: 1760-1669-007: 1669-007. Unpublished study prepared by Covance Laboratories GmbH. 110 p.
41278127	Bruhl, R. and J. Celorio (1980a) W15 Propamocarb: Degradation of Propamocarb Hydrochloride in a Loamy Sand. Laboratory Project ID: R+S71/80 PA66752 71/6. Unpublished Study Performed by Schering AG, Berlin, Federal Republic of Germany, and Submitted by Nor-AM Chemical Company, Wilmington, DE.
93193032	Chow, N.L. and R.R. Stevens (1990f) Phase 3 Summary of MRID 41278127 (W15) Propamocarb HC1 Degradation of Propamocarb HC1 in a Loamy Sand. Laboratory ID: R+S71/80 PA66752 71/6. Unpublished Summary Prepared and Submitted by Nor-Am Chemical Company, Wilmington, DE.
71466	Iwan, J.; Wi, ? (1979) Metabolism of Propamocarb Hydrochloride by Soil Microorganisms: R + S 38/79--PA 66 752.73/2. Rept. of progress no. 1. (Unpublished study received Feb 24, 1981 under 2139-121; prepared by Schering AG, West Germany, submitted by Nor-Am Agricultural Products, Inc., Naperville, Ill.; CDL: 244472-I)

162-2 Anaerobic soil metabolism

MRID	Citation Reference
41278129	Bruhl, R. (1979) W20 Propamocarb HCL: Degradation of SN 66 752 in a Loamy Sand under Anaerobic Conditions: Lab Project Number: PA/66/752/71/6. Unpublished study prepared by Schering AG. 11 p.
93193035	Chow, N.L. and R.R. Stevens (1990h) Phase 3 Summary of MRID 41278129 (W20) Degradation of SN66752 in a Loamy Sand under Anaerobic Conditions: Laboratory ID: PA66752 71/6. Unpublished Summary Prepared and Submitted by Nor-Am Chemical Company, Wilmington, DE.

162-3 Anaerobic Aquatic Sediment metabolism

71465	Bruhl, R.; Celorio, J.; Wi, ? (1980) Anaerobic Degradation of Propamocarb Hydrochloride in River Sediment: R + S 60/80--PA 66 752.71/6. (Unpublished study received Feb 24, 1981 under 2139-121;

	prepared by Schering AG, West Germany, submitted by Nor-Am Agricultural Products, Inc., Naperville, Ill.; CDL: 244472-H)
93193036	Chow, N.L. and R.R. Stevens (1990a) Phase 3 Summary of MRID 00071465 (W21): Anaerobic Degradation of Propamocarb Hydrochloride in River Sediment. Laboratory ID No: R+S 60/80 PA66752 71/6. Unpublished Summary Prepared and Submitted by Nor-Am Chemical Company, Wilmington, DE.

162-3 Anaerobic Aquatic

44538504	Judge, D.N. (1998) W144-1 Propamocarb: The Degradation of [1-14C]Propamocarb under Laboratory Anaerobic Aquatic Conditions. Laboratory Project ID: AV97E517. Unpublished Study Performed by AgrEvo USA Company, Pikesville, NC and Submitted by AgrEvo USA Company, Wilmington, DE.

163-1 Leach/adsorp/desorption

MRID	Citation Reference
71457	Nor-Am Agricultural Products, Incorporated (1979) Soil Dissipation Studies with Propamocarb Hydrochloride. (Compilation; unpub- lished study, including published data, received Feb 24, 1981 under 2139-121; CDL:244471-A)
71469 or 71472	Bruhl, R.; Celorio, J.; Wi, ? (1979) Mobility of SN 66 752 in Two Standard Soils: **R + S 68/79--PA 66 752.71/6.** (Unpublished study received Feb 24, 1981 under 2139-121; prepared by Schering AG, West Germany, submitted by Nor-Am Agricultural Products, Inc., Naperville, Ill.; CDL:244473-B)
71470	Ot, ?; Wi, ? (1978) Leaching of Propamocarb-hydrochloride in Three German Standard Soils: PA 66 752.71/5. (Unpublished study, in- cluding published German text, received Feb 24, 1981 under 2139-121; prepared by Schering AG, West Germany, submitted by Nor-Am Agricultural Products, Inc., Naperville, Ill.; CDL: 244473-C)
71471 or 41278132	Bruhl, R.; Wi, ? (1978) Mobility of Propamocarb Hydrochloride in Four Soils: PA 66 752.71/6. (Unpublished study received Feb 24, 1981 under 2139-121; prepared by Schering AG, West Germany, submitted by Nor-Am Agricultural Products, Inc., Naperville, Ill.; CDL:244473-D)
71472	Bruhl, R.; Celorio, J.; Wi, ? (1979) Mobility of SN 66 752 in Two Soils after Aging: **R + S 28/79--PA 66 752.71/6.** (Unpub- lished study received Feb 24, 1981 under 2139-121; prepared by Schering AG, West Germany, submitted by Nor-Am Agricultural Products, Inc., Naperville, Ill.; CDL:244473-E)
93193036	Chow, N.L. and R.R. Stevens (1990b) Phase 3 Summary of MRID 00071472 (W30): Mobility of SN 66 752 in Two Soils after Aging: R + S 28/79--PA 66 752. Laboratory ID: R+S 28/79 PA66752 71/6.

	Unpublished Summary Prepared and Submitted by Nor-Am Chemical Company, Wilmington, DE.
71473	Bruhl, R.; Wi, ? (1979) Adsorption-desorption of Propamocarb Hydrochloride in Soil and Sediment: R + S 63/79--PA 66 752.71/ 6. (Unpublished study received Feb 24, 1981 under 2139-121; prepared by Schering AG, West Germany, submitted by Nor-Am Agricultural Products, Inc., Naperville, Ill.; CDL:244473-F)
93193037	Chow, N.L. and R.R. Stevens (1990i) Phase 3 Summary of MRID 41278130 (W59): Adsorption to and Desorption from Soil. Laboratory ID: UPSR/19/88. Unpublished Summary Prepared and Submitted by Nor-Am Chemical Company, Wilmington, DE.
41278130	Bruhl, R. (1988) W59 Propamocarb Hydrochloride: Adsorption to and Desorption from Soil: Lab Project Number: UPSR/19/88. Unpublished study prepared by Schering AG. 41 p.
41278131	Feyerabend, M. (1988) W69 Propamocarb: The Mobility of N-(3-dimethylamino-?1-14C|-Propyl)-Propamocarb-Hydrochloride in Four Soils Determined by Soil TLC: Lab Project Number: UPSR/88/88. Unpublished study prepared by Schering AG. 30 p.
93193038	Chow, N.L. and R.R. Stevens (1990j) Phase 3 Summary of MRID 41278131 (W69): The Mobility of Propamocarb-HC1 in Four Soils as Determined by Soil TLC. Laboratory ID: UPSR 88/88. Unpublished Summary Prepared and Submitted by Nor-Am Chemical, Wilmington, DE.
41278132	Bruhl, R. (1978) W29 Propamocarb HCL: Mobility of Propamocarb Hydrochloride in Four Soils: Lab Project Number: PA/66/752/71/6. Unpublished study prepared by Schering AG. 15 p.
93193039	Chow, N.L. and R.R. Stevens (1990k) Phase 3 Summary of MRID 41278132 (W29): Mobility of Propamocarb-HC1 in Four Soils. Laboratory ID: PA66752 71/6. Unpublished Summary Prepared and Submitted by Nor-Am Chemical, Wilmington, DE.
44049501	Carlton, R. (1995) W133 Propamocarb (Propamocarb Hydrochloride Aqueous Solution, 722 g/L, CP 604): Column Leaching in an Acid Soil and an Alkali Soil--A Comparative Study: Lab Project Number: A54511: ENVIR/42AV: ENVIR/95/17. Unpublished study prepared by AgrEvo UK Ltd. 22 p.
45894320	Willems, H. (1998) Aged Leaching of Propamocarb Hydrochloride: Lab Project Number: 220758. Unpublished study prepared by NOTOX B.V. 38 p.
45894321	Willems, H. (1998) Adsorption/Desorption of Propamocarb Hydrochloride on Soil: Lab Project Number: 220769. Unpublished study prepared by NOTOX B.V. 41 p.

164-1 Terrestrial field dissipation

MRID	Citation Reference

71457	Nor-Am Agricultural Products, Incorporated (1979) Soil Dissipation Studies with Propamocarb Hydrochloride. (**Compilation**; unpub- lished study, including published data, received Feb 24, 1981 under 2139-121; CDL:244471-A)
86068	Nor-Am Agricultural Products, Incorporated (1981) Residue Report: Soil: 66752/NA 47. (**Compilation**; unpublished study received Oct 29, 1981 under 2139-121; CDL:246162-C)
44001601	Cole, M. (1995) Dissipation of Propamocarb.HCl in Soil Following Application of Banol to Bare Plot, USA, 1993: Lab Project Number: AV-93R-01: A54951: W132. Unpublished study prepared by AgrEvo USA Co. 161 p.
45551201	Cole, M. (2000) Dissipation of Propamocarb in Soil Following Application of Banol to Bare Plot at the Maximum Proposed Rates, USA, 1996: Lab Project Number: AE B006752 00 SL67 A1: AV-96R-04. Unpublished study prepared by Aventis CropScience. 232 p.
45894322	Willard, T. (2002) Terrestrial Field Soil Dissipation of Propamocarb Hydrochloride in Turf: Final Study Report: Lab Project Number: AA010716: 01-0027: ENC-1/02. Unpublished study prepared by American Agricultural Services, Inc. 406 p.
42421202	Wred-Rucker, A. (1992) W115 Propamocarb Hc1: Dissipation of Propamocarb X HC1 in Soil Following Application of Banol – USA 1990. Report No. UPSR 57/91. Study No. PF-R 89093. Unpublished Study Performed by Schering AG, Berlin, Germany and Submitted by Nor-Am Chemical Company, Goldsboro, NC.
43679701	Adverse effects notification

165-1 Confined rotational crop- check with HED

MRID	Citation Reference
44847301	Meyer, B. (1999) Uptake of (carbon-14)-Propamocarb Hydrochloride Residues in Soil by Rotational Crops under Confined Conditions: Lab Project Number: 518AV: A91264: W147-1. Unpublished study prepared by AgrEvo USA Co. 108 p. Relates to L0000450. {OPPTS 860.1850}
45202401	Meyer, B. (2000) Uptake of (carbon 14)-Propamocarb Hydrochloride Residue in Soil by Rotational Crops Under Confined Conditions (Amended Report Replacing Report AV96E518, Document A91264): Lab Project Number: 518AV: AV96E518A: B002934. Unpublished study prepared by Aventis CropScience. 108 p. {OPPTS 860.1850}

165-2 Field rotational crop- check with HED

MRID	Citation Reference

43984015	Feyerabend, M. (1994) M16 Propamocarb: Rotational Plant Uptake in Soybean, Sugarbeet, and Oat of (1-(carbon 14))-Propyl- Propamocarb Hydrochloride: Lab Project Number: 66 752/72: PF-S 8 1042: U/R 76/93. Unpublished study prepared by Schering AG. 36 p.
44847302	Singer, S. (1999) At Harvest Propamocarb Hydrochloride Derived Residues in Rotational Crops Following Sequential Applications of Banol to Bare Soil Maximum Proposed Rate and the Shortest Rotational Interval, USA 1997: Lab Project Number: AV-97R-04: C003451. Unpublished study prepared by AgrEvo USA Co. 271 p. Relates to L0000450. {OPPTS 860.1900}
45090806	Singer, S. (1999) At Harvest Propamocarb Hydrochloride Derived Residues in Rotational Crops Following Sequential Applications of BANOL to Bare Soil at the Maximum Proposed Rate and the Shortest Rotational Interval, USA, 1997: Lab Project Number: AV-97R-04: C003451: R01-01. Unpublished study prepared by AgrEvo USA Company. 271 p. {OPPTS 860.1900}

165-4 Bioaccumulation in fish

MRID	Citation Reference
45894323	Mazzonetto, F. (2001) Bioconcentration of Proplant to Zebrafish (Danio rerio): Final Report: Lab Project Number: RF-0998.210.022.01. Unpublished study prepared by BIOAGRI Laboratorios Ltda. 92 p.
41278114	Gray, C.; Knowles, C. (1980) W34 Propamocarb HCL: Uptake of propamocarb hydrochloride by bluegills and channel catfish. **Chemosphere (9):329-333.**
71476	Gray, C.; Knowles, C.O. (1979) Uptake of Propamocarb Fungicide by Bluegills and Channel Catfish. (Unpublished study received Feb 24, 1981 under 2139-121; prepared by Univ. of Missouri, Dept. of Entomology, submitted by Nor-Am Agricultural Products, Inc., Naperville, Ill.; CDL:244473-I)
93193041	Chow, N.L. and R.R. Stevens (1990c) Phase 3 Summary of MRID 00071476 (W35) and 41278114 (W34) Uptake, Metabolic Fate and Tissue Residues of propamocarb bluegills and channel catfish. Unpublished Summary Prepared and Submitted by Nor-Am Chemical Company, Wilmington, DE.

Non Guideline Selections

46126502	Netzband, D.; Millan, A. (2003) Propamocarb: Analytical Method for the Determination of Propamocarb (AE B039744) and its Metabolites

	AE F155306, AE F132679, AE F132675 and Proamocarb Glucuronide in Animal Matrices Using LC/MSMS. Project Number: AV/01/03. Unpublished study prepared by Bayer CropScience LP. 45 p.
45894316	Melkebeke, T. (2000) Validation of an Analytical Method for the Determination of Propamocarb Residues in Surface Water: Lab Project Number: 289676. Unpublished study prepared by NOTOX. 27 p.
45894317	Melkebeke, T. (1997) Validation of an Analytical Method for Residues of Propamocarb in Soil: Lab Project Number: 174904. Unpublished study prepared by NOTOX. 19 p.

Appendix B

Analyses of the Un-identified Un-extracted Residues in Submitted Aerobic Soil Studies

The un-extracted residues (UER) results suggest that appropriate extraction methods were used in **soils 1, 2 and 3** (UER near or <10%) while extractions were probably incomplete in **all other soils** leaving un-extracted parent, other un-known degradate and/or residues incorporated into the soil as bound residues[16]. Based on the ***first step*** of the UER Guidance[17], UER quantity in **soils 1, 2 and 3** may assumed to be of no concern (i.e., sink) and half-life may be calculated from parent data alone.

The ***second step*** of the UER guidance calls for an examination of the adequacy of the extraction method used in the soils having levels of >10% UER. Based on the results of this examination, UER can be considered of no concern or be added to the parent as part of the residues of concern. However, before conducting an examination of the extraction systems, it would be useful to understand the relationship between UER formation/persistence and characteristics of the soils. **Table 3.3** contains a summary of the characteristics of the soils used in these studies along with important incubation parameters.

Table A.1 Characteristics of the German soils used in submitted studies and incubation parameters (**Note:** Soil 2 from CA; LD= low dose rate and LT= Incubated at low temperature)

			Study: Biomass, Rate (ppm) and Length (days) [3]				***Soil Characteristics*** [4]				
Soil ID	***Textural Class*** [1]	***Soil Reaction*** [2]	***Start (End) Biomass***	***Rate***	***Incubation Temperature***	***Length***	***pH***	***O.C%***	***Clay%***	***CEC***	***MRID*** [5]
1	LS	Neutral	**Not reported**	200	25 ^{O}C	90	6.6	2.4%	5%	11	412781-25 (A)
2	LS	S. acidic	**Not reported**	200	25 ^{O}C	90	5.2	1.1%	4%	5	412781-26 (S)
3	LS	Neutral	**Not reported**	200	25 ^{O}C	46	6.6	2.3%	7%	**NR**	412781-27 (A)
4	SL	Neutral	451 (231)	250	20 ^{O}C	365					
4 LD	SL	Neutral	**Not reported**	10	20 ^{O}C	120					
4 LT	SL	Neutral	**Not reported**	250	10 ^{O}C	120	7.1	2.5%	11%	15	
5	SiL	Neutral	621 (640)	250	20 ^{O}C	120	6.7	4.5%	20%	18	
6	CL	M. alkaline	395 (372)	250	20 ^{O}C	120	8	2.7%	34%	22	
7	SL	S. acidic	199 (124)	250	20 ^{O}C	120	5.5	1.3%	12%	11	458943-19 (S)

[1] ***Soil Textural Class:*** LS= Loamy Sand; SL= Sandy Loam; SiL= Silt Loam; CL= Clay loam.
[2] **Soil *Reaction:*** S. acidic= Strongly acidic; M. alkaline= Moderately alkaline as per USDA, NRC soil reaction classification. URL: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052208.pdf
[3] ***Other Parameters: Maximum Water holding capacity (WHC)*** at 0.33 bar while soils **4, 5, 6 & 7** at 45% of the maximum WHC ending up containing considerably more water than the 75% of the WHC at 0.33 bar; ***Start (End) Biomass*****=** Biomass in µg C/g at the start of the experiment and at the end of the experiment; and ***Rate*****=** Propamocarb rate applied to the soil in ppm noting that the Current maximum single rate is 64.32 lbs. a.i/A≈ 31.5 ppm (calculated for the top 6" of the soil) therefore, rates used were 6-8 times higher than appropriate rate except in the LD soil in which the rate was 1/3.

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[16] Two terms are used herein, **UER**= Residues left in the soil/sediment following extraction and **Bound residues**= Residues left in soil/sediment that could not be extracted following required extraction attempts as per the UER Guidance.

17 Un-extracted Residues Guidance: URL: http://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/guidance-addressing-unextracted-pesticide-residues http://www.epa.gov/pesticides/science/efed/policy_guidance/team_authors/environmental_fate_tech_team/Unextracted_Residues_in_Lab_Studies.htm

			Study: Biomass, Rate (ppm) and Length (days) [3]				Soil Characteristics [4]				
Soil ID	*Textural Class* [1]	*Soil Reaction* [2]	*Start (End) Biomass*	*Rate*	*Incubation Temperature*	*Length*	*pH*	*O.C%*	*Clay%*	*CEC*	*MRID* [5]

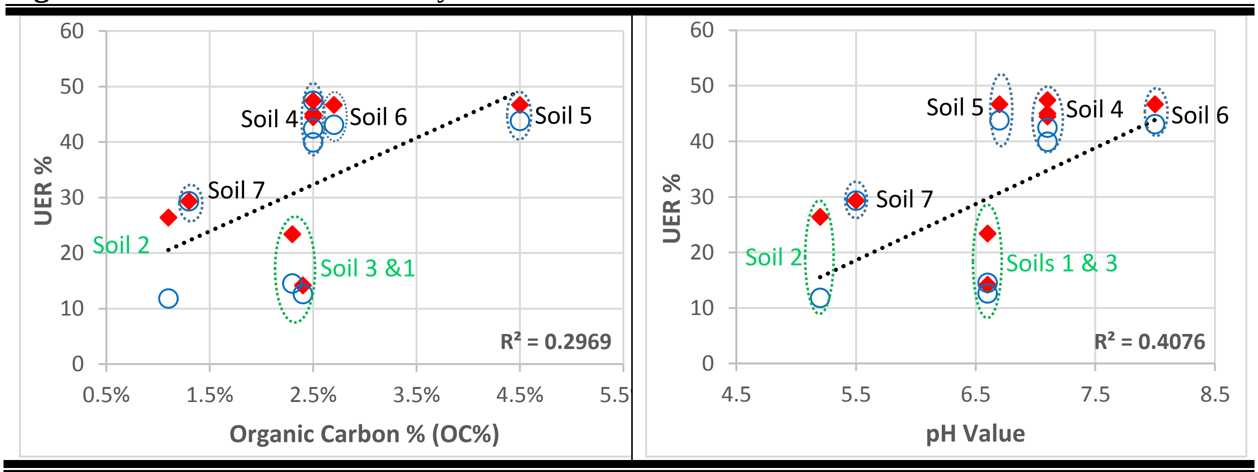
[4] ***Soil Characteristics:*** O.C%= Organic carbon%; CEC= Cation exchange capacity in meq/100 g of soil
[5] ***MRIDs:*** Additional summaries under MRIDs 931930-34 (A) 412781-26 and 931930-34/31/32 were submitted as addendums to studies with MRIDs: 412781-25/26/27, respectively. **Study Classification**: A= Acceptable and S= Supplemental

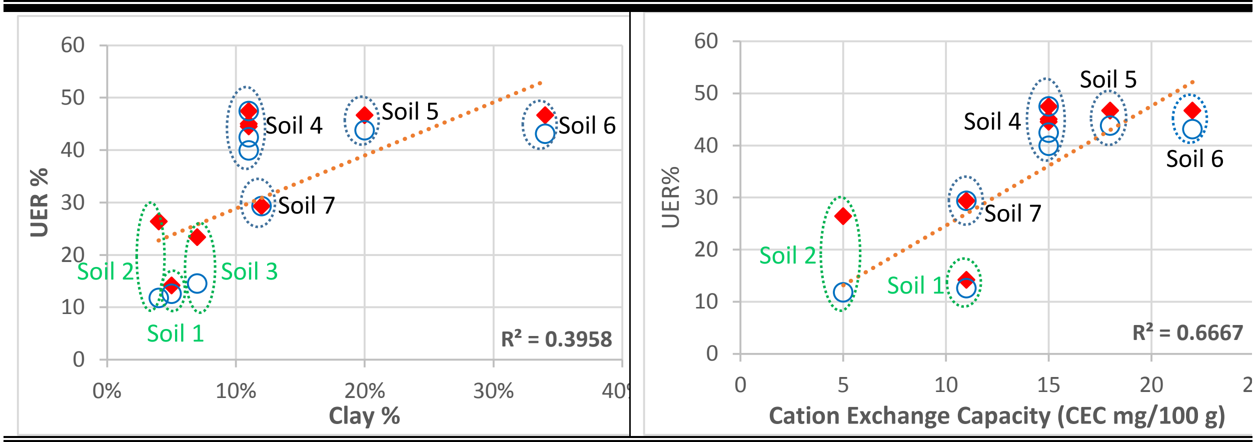
Soil characteristic may be grouped as follows:

- **Strongly Acidic soils** with an O.C content ranging from 1.1-1.3% and:
  a. A clay content of 4% and a CEC of 5 meq/100 g (**Soil 2**); or
  b. A clay content of 12% and a CEC of 11 meq/100 g (**Soil 7)**.
- **Neutral soils** with an O.C content ranging from 2.3 to 2.5% and
  a. A clay content of 5-7% and a CEC of 11 meq/100 g (**Soils 1 & 3**); or
  b. A clay content of 11% and a CEC of 15 meq/100g (**Soil 4**);
- **Neutral soils** with an O.C content of 4.5%, clay content of 11% and a CEC of 18 meq/100g (**Soil 5)**; and
- **Moderately alkaline soils** with an O.C content of 2.7%, clay content of 34%, and a CEC of 22 meq/100g (**Soil 6)**.

Figure A.1 represent the relationship between UER levels (maximum & end of study) with the important characteristic of the soils.

Figure 3.2 Maximum/end of study concentration of UER as related to the soil characteristics





Note: The observed UER (% of parent applied radioactivity) for each soil is represented by two points shown within the dotted circles with the first point "red diamond" being the observed maximum concentration while the second point "empty blue circules" being the observed concentration at the end of the study. The gap between the two points indicates the amount of UER decline which ranges from a maximum of 15% in **soil 2** to 8.9% in **soil 3** to a minimum of 2-5% in **soils 1, 4 and 4 LD**. If the two points are equal (e.g., soils 7 and 4 LT) then the maximum concentration occurred at the end of the study (i.e., no decline observed)

Data in **Figure 3.2** suggest the following:

- A positive relationship between the concentration of the UER and CEC (highest with an R^2= 0.7)> pH> clay content> organic carbon (lowest with an R^2=0.3);
- UER forms at relatively low level and/or show a clear decline in **strongly acidic or neutral (near the acidic range)** soils with relatively low OC content (<2.5%), clay (<10%) and CEC (≤11 meq/100g); in **soils 1, 2 and 3**
- UER forms at relatively high level and shows no or slight decline in:

a. **Strongly acidic** with relatively low OC content and moderate clay and CEC; **Soil 7**;
b. **Neutral** (**Soils 4 and 5**) or **moderately alkaline** (**Soil 6**) soils with variable OC content (2.5- 4.5%), clay (11-34%), and CEC (15-22 meq/100g)

Based on these results and on the assumption of adequate extraction, formation of relatively high UER and persistence appear to increase as a result of the increase in OC/clay content or the CEC of the soil. High UER formation and persistence were also observed in neutral, moderately alkaline soils and strongly acidic soils with relatively high content of OC and clay.

For executing the ***second step*** of the UER guidance, a summary of the characteristics of the various soil/sediment extraction systems are presented in **Table 3.4**. Extraction systems used in aerobic/anaerobic soil/aquatic systems are also included in the same **Table 3.4**.

Table 3.4 Characteristics of the soil/sediment extraction systems

Extraction Steps	***Aerobic/Anaerobic Soils*** [1]			***Aerobic Aquatic***		***Anaerobic Aquatic***	
	1 & 2	***3 & Anarb.***	***4, 5, 6 & 7***	***1 & 2***	***3 & 4***	***1***	***2***
First Step	**Me-OH** (3 times)	**Me-OH** (3 times)	**ACNTRL: Conc. HCl** (3 times)	**30% HCl and ACNTRL** (1 time)	**Me-OH: Sat. NaCl** (4 times)	**ACTNTRL: 0.13 HCl** (3 times)	**ACTNTR: 0.12 HCl** (3 times)

Second Step	**Acetone** (1 time)	**Acetone** (1 time)	**ACNTRL: Conc. HCl** (4 times)	**ACNTRL: 30% HCl** (1 time)	**Di-chloroethane** Only 2&7 d (4 times)	**Soxhlet w/ ACTNTRL: H_2O** (1 time)	**Microwave Me-OH: H_2O** (1 time)
Third Step	**Toluene** (1 time)	**Toluene** (1 time)	**Me-OH: Sat. NaCl** if 2nd Extraction >3% (1 time)	**Soxhlet w/ ACTNTRL: H_2O** Only 14-105 d (1 time)	**Acetone** Only 2 & 7 d (3 times)	None	None
Fourth Step	**Soxhlet** W/ **Me-OH** (1 time)	**5 N NaCl** (1 time)	None	None	**Soxhlet with Me-OH**. Only 2 & 7 and >14 d (1 time)	None	None
Fifth Step	**5 N NaCl** (1 time)	None	None	None	None	None	None
UER [2]	**Acceptable Level**[2]		**Un-acceptable Level**	**Acceptable Level**			
Extraction System	With the exception of **toluene** (solubility= **0.14 ppm**), the chemical is highly soluble in all solvents used: **water >700 ppm**, **Me-OH= 656 ppm** and **Acetone 560 ppm**						
	Polar & non-polar solvents with different dielectric constants [3]		**Polar solvents** with different dielectric constants [3]	**Polar solvents** w/different dielectric constants [3]	**Polar & non-polar solvents** w/ different dielectric constants [3] *	**Polar solvents** w/different dielectric constants [3]	
	Neutral		**Acidic**	**Acidic**	**Neutral**	**Acidic**	

[1] ***Aerobic/Anaerobic Soils:*** refer to **Table A.1**, above, for soil ID/Characteristics noting that the anaerobic soil study used soil 1 incubated in anaerobic conditions at 25 ^{o}C; **ACTNTRL: Conc. HCl=** Acetonitrile: deionized **H_2O**: concentrated HCl (70:30:1, v: v: v); **ACTNTRL: 30% HCl=** Acetonitrile: 30% HCl (29s 11, v:v**)**; **ACTNTRL: 0.13 HCl=** Acetonitri1e: 0.13 M HCl (9: 1, v: v); and
ACTNTRL: 0.12 HCl= Acetonitri1e: 0.12 M **HCl** (8: 2, v: v); **Me-OH: Sat. NaCl=** Methano1: Saturated NaCl (100:25, v: v)
Soxhlet with ACTNTRL: Water= Soxhlet extracted with acetonitrile: water (4: 1, v: v)

[2] **Un-extracted residues (UER) level: Acceptable level=** Near or <10% and/or declined to near or <10% and **Un-acceptable level=** observed maximums ranged from 29 to 49% with no or no apparent decline

[3] **Reported dielectric constants: Polar solvents** used: **Water= 80.1**; **Me-OH= 32.7**; **Acetonitrile= 37.5** and **Acetone= 20.7** and
Non-polar solvent: Di-chloroethane= 8.93 and Toluene= 0.14. The dielectric constants for other compounds used are: HCl= 4.1 and NaCl= 6.1. URLs: http://depts.washington.edu/eooptic/linkfiles/dielectric_chart%5B1%5D.pdf and https://www.kabusa.com/Dilectric-Constants.pdf

Data in **Table 3.4** indicate that adequate extraction was achieved in neutral polar/non-polar systems with an acceptable level of UER remaining in soils/sediments (aerobic soils 1, 2 and 3 and aerobic aquatic systems 3 and 4). Similar results were obtained by using acidic polar solvents combined with Soxhlet or microwave extraction steps (Aerobic aquatic systems 1 and 2 and anaerobic aquatic systems 1 and 2). Inadequacy of extraction was observed in soils 4, 5, 6 and 7 with unacceptable UER level ranging from 29 to 48% observed at the end of these studies. When compared to the adequate extraction observed in all aerobic/anaerobic aquatic and in aerobic/anaerobic soils 1, 2 and 3, extraction system used for soils 4, 5, 6 and 7 d was inadequate possibly because it lacked ***either*** the presence of non-polar solvent ***or*** the extra extraction step (Soxhlet or microwave). It is noted that other extraction systems were used including:

(1) **Methanol (Me-OH): Saturated NaCl** in environmental chemistry method (ECM) for soils with Recovery of 83% (MRID 458943-17);

(2) **HCl acidified Acetone** in one of the terrestrial field dissipation studies (TFD) for soils with Recoveries of 82-94% ± 4-9% (MRID 440016-01); and

(3) **Me-OH: 0.1 N NaOH** w/ **Saturated NaCl** in another TFD studies for soil/field fortified/stored frozen soil samples with recoveries of 94% ± 10% (MRID 458943-22).

In these three systems, adequacy of extraction was achieved with polar solvents alone without the Soxhlet or microwave extraction step. It is noted however, that a good-faith effort to extract the residues were made and therefore, the UER is considered as bound residue.

Appendix C. Example T-REX (v.1.5.2) Output for Propamocarb

Summary of Risk Quotient Calculations Based on Upper Bound Kenaga EECs

Table X. Upper Bound Kenaga, Acute Avian Dose-Based Risk Quotients													
Size Class (grams)	Adjusted LD50	EECs and RQs											
		Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds		Arthropods		Granivore	
		EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
20	172.90	72.23	0.42	33.10	0.19	40.63	0.23	4.51	0.03	28.29	0.16	1.00	0.01
100	220.11	41.19	0.19	18.88	0.09	23.17	0.11	2.57	0.01	16.13	0.07	0.57	0.00
1000	310.92	18.44	0.06	8.45	0.03	10.37	0.03	1.15	0.00	7.22	0.02	0.26	0.00

Table X. Upper Bound Kenaga, Subacute Avian Dietary Based Risk Quotients										
	EECs and RQs									
	Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds		Arthropods	
LC50	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
1740	63.42	0.04	29.07	0.02	35.67	0.02	3.96	0.00	24.84	0.01

Size class not used for dietary risk quotients

Table X. Upper Bound Kenaga, Chronic Avian Dietary Based Risk Quotients										
	EECs and RQs									
	Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds		Arthropods	
NOAEC (ppm)	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
226	63.42	0.28	29.07	0.13	35.67	0.16	3.96	0.02	24.84	0.11

Size class not used for dietary risk quotients

Table X. Upper Bound Kenaga, Acute Mammalian Dose-Based Risk Quotients													
Size Class (grams)	Adjusted LD50	EECs and RQs											
		Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds		Arthropods		Granivore	
		EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
15	457.15	60.46	0.13	27.71	0.06	34.01	0.07	3.78	0.01	23.682	0.052	0.84	0.002
35	369.88	41.79	0.11	19.15	0.05	23.51	0.06	2.61	0.01	16.367	0.044	0.58	0.002
1000	159.99	9.69	0.06	4.44	0.03	5.45	0.03	0.61	0.00	3.7948	0.024	0.135	8E-04

Table X. Upper Bound Kenaga, Acute Mammalian Dietary Based Risk Quotients										
LC50 (ppm)	EECs and RQs									
	Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds		Arthropods	
	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
0	63.42	#DIV/0!	29.07	#DIV/0!	35.67	#DIV/0!	3.96	#####	24.84	######

Size class not used for dietary risk quotients

Table X. Upper Bound Kenaga, Chronic Mammalian Dietary Based Risk Quotients										
NOAEC (ppm)	EECs and RQs									
	Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds/ Large Insects		Arthropods	
	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
30	63.42	2.11	29.07	0.97	35.67	1.19	3.96	0.13	24.84	0.83

Size class not used for dietary risk quotients

Table X. Upper Bound Kenaga, Chronic Mammalian Dose-Based Risk Quotients													
Size Class (grams)	Adjusted NOAEL	EECs and RQs											
		Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds		Arthropods		Granivore	
		EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
15	5.06	60.46	11.96	27.71	5.48	34.01	6.73	3.78	0.75	23.68	4.68	0.84	0.17
35	4.09	41.79	10.22	19.15	4.68	23.51	5.75	2.61	0.64	16.37	4.00	0.58	0.14
1000	1.77	9.69	5.48	4.44	2.51	5.45	3.08	0.61	0.34	3.79	2.15	0.13	0.08

Appendix D. Example TerrPlant (v.1.2.2) Output for Propamocarb

Table 1. Chemical Identity.	
Chemical Name	**Propamocarb**
PC code	**119301/119302**
Use	**Cucurbits**
Application Method	**band**
Application Form	
Solubility in Water (ppm)	**48**

Table 2. Input parameters used to derive EECs.			
Input Parameter	**Symbol**	**Value**	**Units**
Application Rate	A	**0.1133**	**y**
Incorporation	I	**1**	none
Runoff Fraction	R	**0.02**	none
Drift Fraction	D	**0.01**	none

Table 3. EECs for Propamocarb. Units in y.		
Description	**Equation**	**EEC**
Runoff to dry areas	(A/I)*R	0.002266
Runoff to semi-aquatic areas	(A/I)*R*10	0.02266
Spray drift	**A*D**	**0.001133**
Total for dry areas	**((A/I)*R)+(A*D)**	**0.003399**
Total for semi-aquatic areas	**((A/I)*R*10)+(A*D)**	**0.023793**

Table 4. Plant survival and growth data used for RQ derivation. Units are in y.				
	Seedling Emergence		**Vegetative Vigor**	
Plant type	**EC25**	**NOAEC**	**EC25**	**NOAEC**
Monocot	**0.25**	**0.25**	**0.125**	**0.125**
Dicot	**0.017**	**0.0011**	**x**	**x**

Table 5. RQ values for plants in dry and semi-aquatic areas exposed to Propamocarb through runoff and/or spray drift.*				
Plant Type	**Listed Status**	**Dry**	**Semi-Aquatic**	**Spray Drift**
Monocot	non-listed	<0.1	<0.1	<0.1
Monocot	listed	<0.1	<0.1	<0.1
Dicot	non-listed	0.20	1.40	<0.1
Dicot	listed	3.09	21.63	1.03
*If RQ > 1.0, the LOC is exceeded, resulting in potential for risk to that plant group.				

Appendix D. STIR (v.1.0) Output

Welcome to the EFED
Screening Tool for Inhalation Risk

This tool is designed to provide the risk assessor with a rapid method for determining the potential significance of the inhalation exposure route to birds and mammals in a risk assessment.

Input

Application and Chemical Information		
Enter Chemical Name	Propamocarb	
Enter Chemical Use	Ornamentals	
Is the Application a Spray? (enter y or n)	y	
If Spray What Type (enter ground or air)	ground	
Enter Chemical Molecular Weight (g/mole)	224.73	
Enter Chemical Vapor Pressure (mmHg)	6.00E-07	
Enter Application Rate (lb a.i./acre)	64.3	
Toxicity Properties		
Bird		
Enter Lowest Bird Oral LD_{50} (mg/kg bw)	2000	
Enter Mineau Scaling Factor	1.15	
Enter Tested Bird Weight (kg)	0.178	
Mammal		
Enter Lowest Rat Oral LD_{50} (mg/kg bw)	2000	
Enter Lowest Rat Inhalation LC_{50} (mg/L)	7.9	
Duration of Rat Inhalation Study (hrs)	4	
Enter Rat Weight (kg)	0.35	

Output

Results Avian (0.020 kg)		
Maximum Vapor Concentration in Air at Saturation (mg/m^3)	7.26E-03	
Maximum 1-hour Vapor Inhalation Dose (mg/kg)	9.12E-04	
Adjusted Inhalation LD_{50}	4.40E+01	
Ratio of Vapor Dose to Adjusted Inhalation LD_{50}	2.07E-05	**Exposure not Likely Significant**
Maximum Post-treatment Spray Inhalation Dose (mg/kg)	6.79E+00	
Ratio of Droplet Inhalation Dose to Adjusted Inhalation LD_{50}	1.54E-01	**Proceed to Refinements**

Results Mammalian (0.015 kg)		
Maximum Vapor Concentration in Air at Saturation (mg/m^3)	7.26E-03	
Maximum 1-hour Vapor Inhalation Dose (mg/kg)	1.15E-03	
Adjusted Inhalation LD_{50}	4.70E+02	
Ratio of Vapor Dose to Adjusted Inhalation LD_{50}	2.44E-06	Exposure not Likely Significant
Maximum Post-treatment Spray Inhalation Dose (mg/kg)	8.54E+00	
Ratio of Droplet Inhalation Dose to Adjusted Inhalation LD_{50}	1.82E-02	Exposure not Likely Significant

Input

Application and Chemical Information	
Enter Chemical Name	Propamocarb
Enter Chemical Use	Cotton
Is the Application a Spray? (enter y or n)	y
If Spray What Type (enter ground or air)	air
Enter Chemical Molecular Weight (g/mole)	274.1
Enter Chemical Vapor Pressure (mmHg)	6.30E-08
Enter Application Rate (lb a.i./acre)	0.25
Toxicity Properties	
Bird	
Enter Lowest Bird Oral LD_{50} (mg/kg bw)	240
Enter Mineau Scaling Factor	1.15
Enter Tested Bird Weight (kg)	0.178
Mammal	
Enter Lowest Rat Oral LD_{50} (mg/kg bw)	208
Enter Lowest Rat Inhalation LC_{50} (mg/L)	2.64
Duration of Rat Inhalation Study (hrs)	4
Enter Rat Weight (kg)	0.35

Output

Results Avian (0.020 kg)		
Maximum Vapor Concentration in Air at Saturation (mg/m^3)	9.29E-04	
Maximum 1-hour Vapor Inhalation Dose (mg/kg)	1.17E-04	
Adjusted Inhalation LD_{50}	1.70E+01	
Ratio of Vapor Dose to Adjusted Inhalation LD_{50}	6.88E-06	Exposure not Likely Significant
Maximum Post-treatment Spray Inhalation Dose (mg/kg)	2.40E-02	
Ratio of Droplet Inhalation Dose to Adjusted Inhalation LD_{50}	1.41E-03	Exposure not Likely Significant

Results Mammalian (0.015 kg)	
Maximum Vapor Concentration in Air at Saturation (mg/m^3)	9.29E-04
Maximum 1-hour Vapor Inhalation Dose (mg/kg)	1.47E-04

Adjusted Inhalation LD_{50}	1.57E+02	
Ratio of Vapor Dose to Adjusted Inhalation LD_{50}	9.34E-07	**Exposure not Likely Significant**
Maximum Post-treatment Spray Inhalation Dose (mg/kg)	3.02E-02	
Ratio of Droplet Inhalation Dose to Adjusted Inhalation LD_{50}	1.92E-04	**Exposure not Likely Significant**

Appendix E. SIP (v.1.0) Output

Table 1. Inputs

Parameter	Value
Chemical name	Propamocarb
Solubility (in water at 25ºC; mg/L)	37
Mammalian LD_{50} (mg/kg-bw)	208
Mammalian test species	laboratory rat
Body weight (g) of "other" mammalian species	
Mammalian NOAEL (mg/kg-bw)	30
Mammalian test species	laboratory rat
Body weight (g) of "other" mammalian species	
Avian LD_{50} (mg/kg-bw)	240
Avian test species	northern bobwhite quail
Body weight (g) of "other" avian species	
Mineau scaling factor	1.15
Mallard NOAEC (mg/kg-diet)	
Bobwhite quail NOAEC (mg/kg-diet)	226
NOAEC (mg/kg-diet) for other bird species	
Body weight (g) of other avian species	
NOAEC (mg/kg-diet) for 2nd other bird species	
Body weight (g) of 2nd other avian species	

Table 2. Mammalian Results

Parameter	Acute	Chronic
Upper bound exposure (mg/kg-bw)	6.3640	6.3640
Adjusted toxicity value (mg/kg-bw)	159.9854	23.0748
Ratio of exposure to toxicity	0.0398	0.2758
Conclusion*	**Drinking water exposure alone is NOT a potential concern for mammals**	**Drinking water exposure alone is NOT a potential concern for mammals**

Table 3. Avian Results

Parameter	Acute	Chronic
Upper bound exposure (mg/kg-bw)	29.9700	29.9700
Adjusted toxicity value (mg/kg-bw)	172.9031	24.0234
Ratio of exposure to acute toxicity	0.1733	1.2475

Conclusion*	**Exposure through drinking water alone is a potential concern for birds**	**Exposure through drinking water alone is a potential concern for birds**

*Conclusion is for drinking water exposure alone. This does not combine all routes of exposure. Therefore, when aggregated with other routes (*i.e*., diet, inhalation, dermal), pesticide exposure through drinking water may contribute to a total exposure that has potential for effects to non-target animals.